ARTHAM
RESOURCE MATERIAL
NO. 1 EDUCATIONAL RESOURCES

# NCERT
## CHAPTER WISE
## TOPIC WISE
### LINE BY LINE QUESTIONS
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BY
SCHOOL OF
EDUCATORS

# MOTION IN A PLANE

## PROJECTILE ON INCLINED PLANE

X – components
$u_x = u\cos\theta$
$a_x = g\sin\theta$

y – components
$u_g = u\sin\theta$
$a_y = g\cos\theta$

Time of flight (T)
$\dfrac{2u\sin\theta}{g\cos\alpha}$

Height (H)
$\dfrac{u^2\sin^2\alpha}{2g\cos\alpha}$

Range (R) $= \dfrac{2u^2}{g}\dfrac{\sin\theta\cos(\alpha+\theta)}{\cos^2\alpha}$

for $R_{max} = \theta = \pi/4 + \alpha/2$

for $H_{max} = \theta = 90°$ or $\alpha = 0°$

## Horizontal projectile

$u_y = 0$, $u_x = u$

$V_{ms} = \sqrt{V_x^2 + V_y^2}$
$= \sqrt{u^2 + g^2t^2}$
$= \sqrt{u^2 + 2gy}$

$\tan\phi = \dfrac{V_y}{V_x} = \dfrac{gt}{u}$

Equation of Trajectory
$Y = \frac{1}{2}gt^2 = \frac{1}{2}g\dfrac{x^2}{u^2}$

Range (R) $= V_x t = u\sqrt{\dfrac{2H}{g}}$

Time of flight (T) $= \sqrt{\dfrac{2H}{g}}$

$x = u_x t = ut$, $t = x/u$

## Equation of motion on Circular track:

$w_f = w_i + \alpha t$
$\theta = w_{ib} + \frac{1}{2}N\alpha t^2 \propto \alpha\theta$
$w_f^2 - w_i^2 = 2\alpha\theta$

### Types of Circular motion:

Uniform circular motion

Non – Uniform Circular motion
1) $V_1 \neq V_2 \neq V_3 \neq V_4$
2) $a_T \neq oms^{-2}$
3) $a^r = \dfrac{V_{ms}^2}{R}$
4) $a_{net} = \sqrt{a_T^2 + a_r^2}$

Types of Circular motion:
1) $a_T$ (Tangential acceleration) $= oms^{-2}$
2) $a_r$ (Radial acceleration) $= \dfrac{V^2}{R}$
3) $a_{net} = \sqrt{a_T^2 + a_0^2} = a_r$

## RELATIVE MOTION ON 2 D – PLANE

motion of one body w.r.t. other: $\vec{V}_{P/Q} = \vec{V}_P - \vec{V}_Q$
$V_{P/Q}$ = velocity of P w.e.t.Q

Umbrella Problem: $V_{mG} = (V_m - V_G) = V_m$
1) $V_{rm}$ = velocity of rain w.r.t man
2) $V_{rm} = V_r - V_m$
3) $\tan\theta = \dfrac{V_m}{V_r}$

River Boat Problem: $V_r = V_{br}\cos\alpha$ & $V_b = V_{br}\sin\alpha$

Shortest distance
$V_{br}\sin\alpha = \dfrac{d}{t} = d_{min} = (V_{br}\sin\alpha)t$
$V_r$ = river velocity
d = width of river
$V_{br} = \sqrt{V_b^2 + V_r^2}$

Shortest time
$t_{min} = \dfrac{d}{V_b} = \dfrac{\sqrt{x^2+d^2}}{\sqrt{V_b^2+V_r^2}}$
Drift (x) $= V_r \cdot t_{min}$
$\tan\theta = \dfrac{V_r}{V_m} = \dfrac{x}{d}$

## Projectile passing same height at two different times $t_1$ and $t_2$ respectively.

1) $y = \frac{1}{2}gt_1t_2$
2) $t_1 = \dfrac{\mu\sin\theta}{g}\left[1 - \sqrt{1 - \left(\dfrac{2gy}{\mu\sin\theta}\right)^2}\right]$
3) $t_2 = \dfrac{\mu\sin\theta}{g}\left[1 + \sqrt{1 - \left(\dfrac{2gy}{\mu\sin\theta}\right)^2}\right]$

### Projective with complimentary angles.
If $\theta_1 = \theta$ then $\theta_2 = 90 - \theta$
1) $R = H\cos\theta$
2) $\dfrac{T\theta}{T_{90-\theta}} = \tan\theta$

## Circular motion

Angular velocity (w):
$W = \dfrac{d\theta}{dt} = \dfrac{2\pi}{T} = 2\pi f\ (rads^{-1})$
T = Time period if = frequency
$\boxed{V = RW}$ — linear velocity $(mS^{-1})$

Angular Acceleration ($\alpha$):
$\alpha = \dfrac{dw}{dt}\ (rads^{-2})$
$\boxed{a = R\alpha}$ — linear acceleration $(mS^{-1})$

Angular displacement ($\theta$):
Final position
Initial position
$\boxed{\ell = R\theta}$ — Angular displacement (rad.)
— Radius (m)
— Arc length (m)

## Projectile motion
### oblique projectile

X – component
· $u_x = u_{\cos}\theta$
· $a_x = 0$

y – component
· $u_g = u_{\sin}\theta$
· $a_g = -g$

Equation of Trajectory (parabolic track)
$y = x\tan\theta - \frac{1}{2}\dfrac{gx^2}{u^2\cos^2\theta} = x\left(1 - \dfrac{x}{R}\right)\tan\theta$

Time of f hight (T): T $= 2u\sin\theta/g$

Range (R) $= u_x T_1 = \dfrac{\mu^2\sin 2\theta}{g}$

Height (H) $= \dfrac{\mu^2\sin^2\theta}{2g}$

## Vector (magnitude + Direction)

### Basic Terminologies

· Null vector: $|\vec{A}| = 0$

· Unit vector: $\hat{A} = \dfrac{\vec{A}}{|\vec{A}|}$, $|\hat{A}| = 1$

· Equal vector: $\vec{A} \parallel \vec{B}$, $|\vec{A}| = |\vec{B}|$

· Axial vector: used in rotation $\vec{V} = \vec{r} \times \vec{w}$

· Orthogonal vector Angle b/w $\vec{A}$ & $\vec{B}$ ($\theta = 90°$)
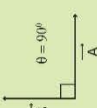
· Parallel Vector: Angel b/w $\vec{A}$ & $\vec{B}$ ($\theta = 0°$) $\Rightarrow |\vec{A}| = n|\vec{B}|$

· Anti-Parallel Vector: Angel b/w $\vec{A}$ & $\vec{B}$ ($\theta = 180°$) $\Rightarrow |\vec{A}| = -n|\vec{B}|$

### Resolution of vector
$P_y = P_{\sin\theta}$
$P_x = P_{\cos\theta}$

### Mathematical operations
(9g $\vec{A} = (a_1\hat{i} + b_1\hat{j} + c_1\hat{K})$ & $\vec{B} = (a_1\hat{i} + b_1\hat{j} + c_1\hat{K})$)

#### Arithmetic operations
Addition
$\vec{A} + \vec{B} = (a_1+a_2)\hat{i} + (b_1+b_2)\hat{j} + (c_1+c_2)\hat{k}$

Subtraction
$\vec{A} + \vec{B} = (a_1-a_2)\hat{i} + (b_1-b_2)\hat{j} + (c_1-c_2)\hat{k}$

#### Multiplication
Dot Product (Scalar Product)
1) $\vec{A} \cdot \vec{B} = |\vec{A}||\vec{B}|\cos\theta$
2) $\vec{A} \cdot \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$
3) $\hat{i}\cdot\hat{i} = 1$
$\hat{i}\cdot\hat{j} = 0$
$\hat{i}\cdot\hat{k} = 0$ etc.

Cross product (vector product)
1) $\vec{A} \times \vec{B} = |\vec{A}||\vec{B}|\sin\theta$
2) $\vec{A}\times\vec{B} = \begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ a_1 & b_1 & c_1\\ a_2 & b_2 & c_2\end{vmatrix}$
$\hat{i}(b_1c_2 - c_1b_2) + \hat{j}(a_1c_2 - c_1a_2) + \hat{k}(a_1b_2 - b_1a_2)$
3) $\hat{i}\times\hat{i} = 0$
$\hat{i}\times\hat{j} = 1$
$\hat{i}\times\hat{k} = -1$

### Lammis Theorem:
$\dfrac{F_1}{\sin\alpha} = \dfrac{F_2}{\sin\beta} = \dfrac{F_3}{\sin\gamma}$

### Parallelogram law:

### Vector laws

Triangle law:
$B_y = B\sin\theta$
$B_x = B\cos\theta$
$\vec{R} = (A + B\cos\theta)\hat{i} + B\sin\theta\,\hat{j}$
$|\vec{R}| = \sqrt{|\vec{A}|^2 + |\vec{B}|^2 + 2|\vec{A}||\vec{B}|\cos\theta}$
$\tan\alpha = \dfrac{|\vec{B}|\sin\theta}{|\vec{A}| + |\vec{B}|\cos\theta}$

# NCERT LINE BY LINE QUESTIONS

1. Two vectors are said to be equal, if
   (a) They have equal magnitude only
   (b) Same direction only
   (c) They have equal magnitude and same direction
   (d) They have unequal magnitude and same direction

2. A null vector has
   (a) Zero magnitude, specified direction
   (b) Zero magnitude, arbitrary direction
   (c) Non-zero magnitude, no direction
   (d) Non-zero magnitude, arbitrary direction

3. To a person moving with a speed of 5 m/s towards east, rain appears to be falling vertically downward with speed m/s. The actual velocity of rain is

   (a) 10 m/s at 30° with vertical
   (b) 20 m/s at 30° with vertical
   (c) 10 m/s at 60° with vertical
   (d) 20 m/s at 60° with vertical

4. A vector can be resolved
   (a) Only in two components
   (b) Only in three components
   (c) In any number of components
   (d) Either two or three components

5. The magnitude of component of a vector
   (a) Is always less than magnitude of vector
   (b) Is always equal to magnitude of vector
   (c) May be greater than magnitude of vector
   (d) Is always greater than magnitude of vector

6. A motor boat is racing towards north at 25 km/h and the water current in that region is 10 km/h in the direction of 60° east of south. The resultant velocity of the boat is nearly
   (a) 22 km/h          (b) 12 km/h          (c) 35 km/h          (d) 26 km/h

7. In uniform circular motion, the centripetal acceleration is
   (a) Due to change in magnitude of velocity only
   (b) Due to change in direction of velocity only
   (c) Due to change in both magnitude and direction of velocity
   (d) Neither due to change in magnitude of velocity nor due to change in direction

8. In circular motion, the direction of angular velocity is
   (a) In the plane of circle              (b) Perpendicular to plane of circle
   (c) In the direction of velocity        (d) In the direction of acceleration

9. The shape of the trajectory of an object is determined by
   (a) Acceleration only                   (b) Velocity of projection only
   (c) Initial position and initial velocity only

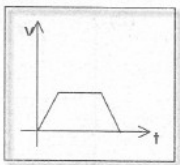(d) Initial position, initial velocity and acceleration

10. Which of the following vector operation is meaningful?
(a) Multiplication of any two vectors (b) Adding any two vectors
(c) Adding a component of vector to the same vector
(d) Both (b) and (c)

11. Which of the following quantities is/are vector?
(a) Angular frequency (b) Angular velocity
(c) Number of moles (d) Both (a) and (b)

12. Which of the following option is correct?
(a) Each component of a vector is always scalar
(b) Three vectors not lying in a plane can never add up to give null vector
(c) Two vectors of different magnitude can be add up to give null vector
(d) Minimum number of vectors to give null vector is five

13. A particle $A$ is moving with velocity $(3\hat{i}+4\hat{j})$ m/s and particle 6 is moving with velocity $(-3\hat{i}-4\hat{j})$ m/s. The magnitude of velocity of $B$ w.r.t $A$ is
(a) 6 m/s (b) 8 m/s (c) 10 m/s (d) 5 m/s

14. If two vectors $\vec{A}=a\hat{i}+6\hat{j}$ $\vec{B}=b\hat{i}+c\hat{j}$ and are equal then correct options for value of a, 6 and c is
(a) a = 4 (b) a = c (c) c = 6 (d) Both (a) and (c)

15. Equation of trajectory of projectile is $y=\sqrt{3}x-5x^{2}$, Then angle of projection with vertical is (Assume x-axis as horizontal and y-axis as vertical)
(a) 45° (b) 30° (c) 60° (d) 53°

16. A projectile is projected with initial velocity $(10\hat{i}+20\hat{j})$ m/s from the ground. The velocity of the body just before hitting the ground is
(a) $10\hat{i}+20\hat{j}$ (b) $-10\hat{i}+20\hat{j}$ (c) $10\hat{i}-20\hat{j}$ (d) $-10\hat{i}-20\hat{j}$

17. The component of $(3\hat{i}+4\hat{j})$ in the direction of $(\hat{i}-\hat{j})$ is
(a) $\dfrac{\hat{j}-\hat{i}}{2}$ (b) $\dfrac{\hat{i}-\hat{j}}{2}$ (c) $\dfrac{1}{\sqrt{2}}(\hat{i}-\hat{j})$ (d) $\dfrac{1}{\sqrt{2}}(\hat{j}-\hat{i})$

18. The correct statement for a scalar quantity is
(a) It is conserved in a process
(b) It can never take negative values
(c) It does not vary from one point to another in space
(d) It has the same value for the observers with different orientations of axis

19. A man can swim with a speed of 5 km/h in still water. How long does he take to cross a river 1.0 km wide, if the river is flowing steadily at 3 km/h and he makes his strokes normal to the river current?
(a) 20 min (b) 30 min (c) 12 min (d) 15 min

20. A particle starts from origin at t=0 s with a velocity 4.0 $\hat{j}$ m/s and moves in $x$-$y$ plane with a constant acceleration of $(6\hat{i}+4\hat{j})$ m/s² - The time after which y-coordinate of particle will be 48 m, will be
(a) 6s (b) 4s (c) 8s (d) 5s

# NCERT BASED PRACTICE QUESTIONS
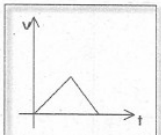
21  Two vectors of same magnitude inclined at an angle θ the resultant will make angle from on vector is

(a) $\dfrac{\theta}{2}$  (b) $\dfrac{\theta}{4}$  (c) $\theta$  (d) $\dfrac{\theta}{6}$

22  A particle is projected at an angle θ with the horizontal then at the top point of trajectory the angle between acceleration and velocity is

(a) 900  (b) 450

(c) 1800  (d) 00

23  A ball is dropped from the top of a tower in a high speed wind. The wind exerts a steady force on the ball. The path followed by the ball will be

(a) Parabola  (b) circular are

(c) elliptical  (d) straight line

24  A boy throws a ball with a velocity v0 at an angle α to the horizontal. At the same instant he starts running with uniform velocity to catch the ball before it hits the ground. To achieve this he should run the velocity of

(a) $v_0 \cos \alpha$  (b) $v_0 \sin \alpha$

(c) $v_0 \tan \alpha$  (d) $\sqrt{v_0^2 \tan \alpha}$

25  When a particle is thrown horizontally, the resultant velocity of the particle at any time t is given by

(a) g t  (b) $\dfrac{1}{2} gt^2$  (c) $\sqrt{u^2 + g^2 t^2}$  (d) $\sqrt{u^2 - g^2 t^2}$

26  When a particle is projected at an angle 30⁰ the horizontal range is 120m if particle is projected at an angle 120⁰ the horizontal range will be

(a) 60 m  (b) 120 m  (c) 180 m  (d) 90 m

27  A particle is thrown upward with a speed u at an angle θ with horizontal. When the particle makes an angle $\phi$ with the horizontal its speed changes to $\upsilon$ then

(a) $\upsilon = u \cos \theta \cos \phi$  (b) $\upsilon = u \cos \theta \sec \phi$

(c) $\upsilon = u \cos \theta$  (d) $\upsilon = u \sec \theta \cos \phi$

28  The particle attain maximum horizontal range when thrown at an angle θ with horizontal value of θ must be

(a) 45⁰  (b) 60⁰  (c) 30⁰  (d) 90⁰

29    If a particle is thrown with initial velocity u then the maximum height attained by the particle if horizontal range is maximum

(a) $\dfrac{u^2}{2g}$    (b) $\dfrac{u^2}{4g}$    (c) $\dfrac{u^2}{g}$    (d) $\dfrac{u^2}{8g}$

30    Maximum height attained by the particle if thrown with initial velocity u and at an angle θ with horizontal

(a) $\dfrac{u^2 \sin^2 \theta}{2g}$    (b) $\dfrac{u^2 \sin^2 \theta}{g}$    (c) $\dfrac{u^2 \sin 2\theta}{g}$    (d) $\dfrac{u^2 \sin 2\theta}{2g}$

31    When a particle is thrown θ with inital velocity u and angle θ with horizontal then time of flight of the particle is

(a) $\dfrac{2u \sin \theta}{g}$    (b) $\dfrac{u \sin \theta}{g}$    (c) $\dfrac{u \cos \theta}{g}$    (d) $\dfrac{2u \cos \theta}{g}$

32    If a particle is moving with constant speed then which of the following can be correct

(a) acceleration must be zero          (b) velocity is constant

(c) acceleration is constant          (d) none of these

33.    If a body is moving in a curved path then

(a)  acceleration may be zero          (b) velocity may be constant

(c) acceleration must not be zero   (d) None of these

34.    If a body is moving with uniform acceleration with inital velocity u and final velocity $\upsilon$ then average velocity of the particle is

(a) $\dfrac{u + \upsilon}{2}$    (b) $\dfrac{u - \upsilon}{2}$    (c) u    (d) $\upsilon$

35.     If a body travels with a uniform acceleration $a_1$ for time $t_1$ and uniform acceleration $a_2$ for time $t_2$ then average acceleration is

(a) $\dfrac{a_1 t_1 + a_2 t_2}{t_1 + t_2}$    (b) $\dfrac{a_1 t_1 + a_2 t_2}{t_1}$    (c) $\dfrac{a_1 t_1 + a_2 t_2}{t_2}$    (d) $\dfrac{a_1 t_1 - a_2 t_2}{t_1 - t_2}$

36.    In the following V-t graphs, identify the graph that represents a body moving with uniform velocity and then with uniform retardation until it stops.

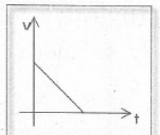(a)          (b)          (c)          (d)

37.    The distance travelled by a body is directly proportional to the square of the time taken. Its acceleration

(a) increases      (b) decreases      (c) become zero      (d) remains constant

38. If $\left|\vec{A}.\vec{B}\right| = \left|\vec{A} \times \vec{B}\right|$ ,then resultant of $\overline{A}$ and $\overline{B}$ is

(a) A + B

(b) A – B

(c) (A² + B² + 2AB)$^{1/2}$

(d) $\left(A^2 + B^2 + \sqrt{2}AB\right)^{1/2}$

39. What can be the angle between $(\overline{A} + \overline{B}) and (\overline{A} - \overline{B})$ ?

(a) $0^0$ only      (b) $90^0$ only      (c) $180^0$ only      (d) between $0^0$ to $180^0$

40 A particle is projected at angle $\theta$ from the horizontal with kinetic energy T. The kinetic energy of the particle at the highest point of the path is

(a) 0      (b) T sin $\theta$      (c) T cos²$\theta$      (d) T sin²$\theta$

41 A cricket ball is hit at $45^0$ to the horizontal with a kinetic energy $E_k$ the kinetic energy at the highest point is

(a) $E_k$      (b) $E_k/2$      (c) $E_k / \sqrt{2}$      (d) zero

42 The vector $(\hat{i} + \hat{j})$ has magnitude

(a) 1      (b) $\dfrac{1}{\sqrt{2}}$      (c) $\sqrt{2}$      (d) 2

43. The ceiling of a long hall is 25m high what is the maximum horizontal distance that a ball thrown with a speed of 40m/s can go without hitting the ceiling of the ball?

(a) 150. 5m      (b) 200.5m      (c) 160.5m      (d) 140.5m

44. A cricketer can throw a ball to a maximum horizontal distance of 100m. Then the night above the ground the cricketer can throw the ball is

(a) 50 m      (b) 60 m      (c) 80 m      (d) 40 m

45. An aircraft executes a horizontal loop of radius 1.00 km with a constant speed of 900 km/h ratio of its centripetal acceleration to the acceleration due to gravity is

(a) 6.4      (b) 3.2      (c) 4.8      (d) 5.4

46. An aircraft is flying at a height of 3400m above the ground. If the angle subs tended at a ground observation point by the aircraft positions 10s apart is $30^0$. Then speed of aircraft is

(a) 182 m/s      (b) 152 m/s      (c) 178 m/s      (d) 148 m/s

47. An object while moving may not have

(a) variable speed but constant velocity

(b) variable velocity but constant speed

(c) Non- zero acceleration but constant speed

(d) Non-zero acceleration but constant velocity

48.  A stone is dropped from a height of 45m what will be the distance travelled by it during last one second of its motion?

(a) 35 m          (b) 25 m          (c) 12.5 m          (d) 10 m

49.  The angle of projection at which the horizontal range and maximum height of projectile are equal is

(a) $45^0$          (b) $60^0$          (c) $\theta = \tan^{-1} 4$          (d) $\theta = \tan^{-1} (0.25)$

50.  Which one is a vector quantity?

(a) energy          (b) torque          (c) both of these          (d) none of these

51.  The angular speed of a flywheel making 120 revolution per minute is

(a) $2\pi$ rad/s                    (b) $4\pi^2$ rad/s

(c) $\pi$ rad/s                     (d) $4\pi$ rad/s

52.  Two bodies A and B of masses 2M and M are dropped from heights 2H and H respectively. The ratio of times $t_A / t_B$ taken by them to reach the ground is

(a) $\dfrac{1}{4}$          (b) 1          (c) $\sqrt{2}$          (d) 2

53.  A man wants to hit a target he should point his riffle

(a) higher than target                    (b) lower than target

(c) in the same direction as target (d) nothing can be said

54.  When a body is thrown horizontally from the top of a tower in air, it follows

(a) horizontal path                    (b) vertical path

(c) parabolic path                    (d) nothing can be said

55.  If $\overline{A} \times \overline{B} = \overline{C}$ which of the following statement is not correct?

(a) $\overline{C} \perp \overline{A}$          (b) $\overline{C} \perp \overline{B}$          (c) $\overline{C} \perp \left(\overline{A} \times \overline{B}\right)$          (d) $\overline{C} \perp \left(\overline{A} + \overline{B}\right)$

56.  The resultant of two forces 10N and 5N can never be

(a) 4N          (b) 5N          (c) 8 N          (d) 12N

57.  If $\overline{A}.\overline{B} = AB$ ,then angle between $\overline{A}$ and $\overline{B}$ is

(a) zero          (b) $90^0$          (c)$180^0$          (d) none of the above

58.  Which of the following operations with two vectors can not be defined in vector algebra?

(a)  addition          (b) subtraction          (c) multiplication          (d) division

59.  Cross product of two similar vector is

(a) zero          (b) 1          (c) infinity          (d) scalar

60. Two vectors $\overline{A}$ and $\overline{B}$ are such that $\left|\overline{A}+\overline{B}\right|=\left|\overline{A}-\overline{B}\right|$ then angle between the vectors $\overline{A}$ and $\overline{B}$ is

(a) $0^0$             (b) $60^0$            (c) $90^0$           (d) $180^0$

## TOPIC WISE PRACTICE QUESTIONS

# Topic 1: Relative Velocity

1. A person standing on a moving truck throws a stone vertically up relative to himself. To a person, standing on the ground, the stone appears to: (immediately after being thrown).

1) Rise vertically up and come down        2) Rise towards the rear of the truck

3) Move along a parabolic path

4) Rise straight and forward but inclined to the direction of motion of truck.

2. Two particles are projected, between a certain time gaps. While both are in air, the velocity of one particle relative to the other:

1) Varies linearly with time          2) Is always constant in magnitude and direction

3) Is always constant in magnitude only      4) is always constant in direction only

3. A man runs along a horizontal road holding his umbrella vertical in order to afford maximum protection from rain. The rain is actually:

1) Falling vertical               2) Coming from front of the man

3) Coming from the back of the man       4) Either of 1), 2) or 3).

4. Two persons P and Q are flying in a helicopter horizontally at a constant speed. All of a sudden, P falls down. During the fall of P, at any instant, Q locates P:

1) Vertically down                       2) Down, at an angle (acute) to the front of vertical

3) Down at an angle (acute) to the rear of vertical

4) Whose position depends upon the speed of the helicopter

5. To the captain of a ship A travelling with velocity $\vec{v}_A = \left(3\hat{i}-4\hat{j}\right)$ km/h, a second ship B appears to have a velocity $\left(5\hat{i}+12\hat{j}\right)$ km/h. What is the true velocity of the ship B?

1) $2\hat{i}+16\hat{j}$ km/h       2) $13\hat{i}+8\hat{j}$ km/h     3) $-2\hat{i}-16\hat{j}$ km/h     4) $8\left(\hat{i}+\hat{j}\right)$ km/h

6. A boat is moving with a velocity $3\hat{i}+4\hat{j}$ with respect to the ground. The water in the river is flowing with a velocity $-3\hat{i}-4\hat{j}$ with respect to the ground. The velocity of the boat relative to the water is

1) $6\hat{i} + 8\hat{j}$      2) $8\hat{i} + 6\hat{j}$      3) $6\hat{i} + 6\hat{j}$      4) none of these

7. A car 'A' moves due north at a speed of 40 km/hr, while another car '13' moves due east at a speed of 30 km/ hr. Find the velocity of car B relative to car A (both in magnitude and direction).

1) 40 km/hr, at an angle $\tan^{-1}\left(\dfrac{3}{5}\right)$ east of south      2) 50 km/hr, at an angle $\tan^{-1}\left(\dfrac{3}{5}\right)$ east of south

3) 40 km/hr, at an angle $\tan^{-1}\left(\dfrac{3}{4}\right)$ east of south      4) 50 km/hr. at an angle $\tan^{-1}\left(\dfrac{3}{4}\right)$ east of south

8. A moves with 65 km/h while B is coming back of A with 80 km/h. The relative velocity of B with respect to A is
(1) 80 km/h      (2) 60 km/h      (3) 15 km/h      (4) 145 km/h

9. A river flow with a speed more than the maximum speed with which a person can swim in the still water. He intends to cross the river by shortest possible path (i.e., he wants to reach the point on the opposite bank which directly opposite to the starting point). Which of the following correct?
(1) He should start normal to the river bank
(2) He should start in such a way that, he moves normal to the bank, relative to the bank.
(3) He should start in a particular (calculated) direction making an obtuse angle with the direction of water current
(4) The man cannot cross the river, in that way

10. A ship A is moving Westwards with a speed of 10 km h$^{-1}$ and a ship B 100 km south of A, is moving Northwards with a speed of 10km h$^{-1}$. The time after which the distance between them becomes shortest, is"
1) 5h      2) $5\sqrt{2}$h      3) $10\sqrt{2}$h      4) 0 h

11. A boat is moving with a velocity 2i + 3j with respect to ground. The water in the river is moving with a velocity –2i – 3j with respect to ground. The relative velocity of the boat with respect to water is
(1) 4 j      (2) –4i + 6j      (3) 4i + 6j      (4) 6j

12. A boat which has a speed of 6 km/hr in still water crosses a river of width 1 km along the shortest possible path in 20 minutes. The velocity of the river water in km/hr is
(1) 5      (2) 4      (3) 3      (4) 1

13. A boat $B$ is moving upstream with velocity 3 m/s with respect to ground. An observer standing on boat observes that a swimmer $S$ is crossing the river perpendicular to the direction of motion of boat. If river flow velocity is 4 m/s and swimmer crosses the river of width 100 m in 50 sec, then
(1) velocity of swimmer w.r.t ground is $\sqrt{13}$m/s
(2) drift of swimmer along river is zero
(3) drift of swimmer along river will be 50 m
(4) velocity of swimmer w.r.t ground is 2 m/s

14. Two boys are standing at the ends A and B of a ground where AB = a. The boy at B starts running in a direction perpendicular to AB with velocity v1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is

1) $\dfrac{a^2}{\sqrt{v^2 + v_1^2}}$      2) $\dfrac{a^2}{v^2 - v_1^2}$      3) $\dfrac{a^2}{v^2 + v_1^2}$      4) $\sqrt{\dfrac{a^2}{v^2 - v_1^2}}$

15. A bus is moving on a straight road towards north with a uniform speed of 50 km/hour turns through 90°. If the speed remains unchanged after turning, the increase in the velocity of bus in the turning process is

(1) 70.7 km/hour along south-west direction    (2) zero

(3) 50 km/hour along west    (4) 70.7 km/hour along north-west direction.

16.    Two cars are moving in the same direction with the same speed 30 km/hr. They are separated by a distance of 5   km, the speed of a car moving in the opposite direction if it meets these two cars at an interval of 4 minutes, will be

(1) 40 km/hr    (2) 45 km/hr    (3) 30 km/hr    (4) 15 km/hr

17.    A car is going in south with a speed of 5 m/s. To a man sitting in car a bus appears to move towards west with a speed of $2\sqrt{6}$ m/s. What is the actual speed of the bus?

1) 4 ms$^{-1}$    2) 3 ms$^{-1}$    3) 7 ms$^{-1}$    4) none of these

18.    A flag is mounted on a car moving due North with velocity of 20 km/hr. Strong winds are blowing due East with velocity of 20 km/hr. The flag will point in direction

1) East    2) North-East    3) South-East    4) South-West

19.    Wind is blowing in the north direction at speed of 2 m/s which causes the rain to fall at some angle with the vertical. With what velocity should a cyclist drive so that the rain appears vertical to him?

1) 2 m/s south    2) 2 rn/s north    3) 4 rn/s west    4) 4 m/s south

20.    A car is moving along a road with a speed of 45 km/hr. In what direction must a body be projected from it with a velocity of 25 m/s, so that its resultant motion is at right angles to the direction of car?

1) At an angle of 120° with the direction of motion of car.

2) At an angle of 60° with the direction of motion of car.

3) At an angle of 90° with the direction of motion of car.

4) At an angle of 135° with the direction of motion of car.

21.    Three ships A, B & C are in motion. The motion of A as seen by B is with speed v towards north-east. The motion  of B as seen by C is with speed v towards the north west. Then as seen by A, C will be moving towards

1) north    2) south    3) east    4) west

22.    A boat travels from south bank to north bank of a river with a maximum speed of 8 km/h. To arrive at a point opposite to the point of start, the boat should start at an angle:

1) $\tan^{-1}(1/2)$ W of N    2) $\tan^{-1}(1/2)$ N of  W

3) $30^0$ W of  N    4) $30^0$ N of  W

23.    A swimmer crosses a flowing stream of width $\omega$ to  and fro in time $t_1$. The time taken to cover the same distance up and down the stream is $t_2$. I f $t_3$ is the time the swimmer would take to swim a distance $2\omega$ in still water, then

1) $t_1^2 = t_2 t_3$    2) $t_2^2 = t_1 t_3$    3) $t_3^2 = t_1 t_2$    4) $t_3 = t_1 + t_2$

24.    A boat having a speed of 5 km/hr. in still water, crosses a river of width I km long the shortest possible path in 15 minutes. The speed of the river in Km/hr.

1) 1  2) 3  3) 4  4) $\sqrt{41}$

25. A man is crossing a river flowing with velocity of 5 m/s. He reaches a point directly across at a distance of 60 m in 5 sec. His velocity in still water should be

(1) 12 m/s  (2) 13 m/s  3) 5 m/s  4) 10 m/s

26. A river is flowing due east with a speed 3 ms$^{-1}$. A swimmer can swim in still water at a speed of 4 ms$^{-1}$. If swimmer starts swimming due north, then the resultant velocity of the swimmer is

1) 3 ms$^{-1}$  2) 5 ms$^{-1}$  3) 7 ms$^{-1}$  4) 2 ms$^{-1}$

27. A boy can swim in still water at 1 m/s. He swims across a river flowing at 0.6 m/s which is 336 in wide. If he travels in shortest possible time, then what time he takes to cross the river?

1) 250 s  2) 420 s  3) 340 s  4) 336 s

28. A man can swim in still water with a speed of 2m/s. If he wants to cross a river of water current speed $\sqrt{3}$ m/s along shortest possible path, then in which direction should he swim?

1) at an angle 120° to the water current

2) at an angle 150° to the water current

3) at an angle 90° to the water current

4) none of these

29. A river flows with a speed more than the maximum speed with which a person can swim in still water. He intends to cross the river by shortest possible path. Which of the following, is correct?

1) He should start normal to the river hank.

(2) He should start in such a way that, he moves normal to the hank, relative to the bank

(3) He should start in a particular (calculated) direction making an obtuse angle with the direction of water current.

4) The man cannot cross the river, in that way.

30. A man wishes to cross a river in a boat. If he crosses the river in minimum time he takes 10 minutes with a drift of 120 m. If he crosses the river taking shortest route, he takes 12.5 minutes. Find velocity of the boat with respect to water.

1) 20 m/min  2) 12 m/min  3) 10 in/min  4) 8 m/min

31. A person walks at the rate of 3 km/hr. Rain appears to him in vertical direction at the rate of $3\sqrt{3}$ km/hr. Find magnitude and direction of true velocity of rain.

1) 6 km/hr, inclined at an angle of 45° to the vertical towards the person's motion.

2) 3 km/hr, inclined at an angle of 30° to the vertical towards the person's motion.

3) 6 km/hr, inclined at an angle of 30° to the vertical towards the person's motion.

4) 6 km/hr, inclined at an angle of 60° to the vertical towards the person's motion.

32. Rain is falling vertically with a speed of 35 m/s. Wind starts blowing after sometime with a speed of 12 m/s in east to west direction. At what angle with the vertical should a boy waiting at a bus stop hold his umbrella to protect himself from rain?

1) $\sin^{-1}\left(\dfrac{12}{35}\right)$      2) $\cos^{-1}\left(\dfrac{12}{35}\right)$      3) $\tan^{-1}\left(\dfrac{12}{35}\right)$      4) $\cot^{-1}\left(\dfrac{12}{35}\right)$

33. Two cars A and B are moving as shown in figure. Calculate the relative velocity of A with respect to B. Also draw the direction of motion of car A as seen from car B.
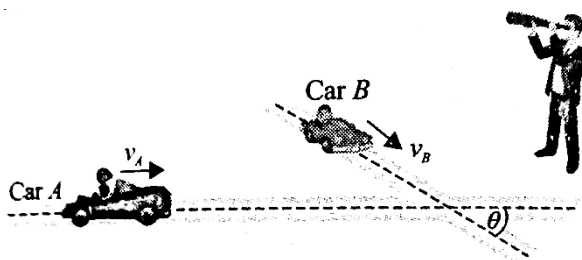


1) $\sqrt{v_A^2 + v_B^2 + 2v_A.v_B \cos\left(180^0 - \theta\right)}$, $\tan^{-1}\left(\dfrac{v_B \sin\theta}{v_A - v_B \cos\theta}\right)$

2) $\sqrt{v_A^2 + v_B^2 + 2v_A.v_B \cos\left(180^0 + \theta\right)}$ , $\tan^{-1}\left(\dfrac{v_B \sin\theta}{v_A + v_B \cos\theta}\right)$

3) $\sqrt{v_A^2 + v_B^2}$,      $\tan^{-1}\left(\dfrac{v_B \sin\theta}{v_A + v_B \cos\theta}\right)$    4) $\sqrt{v_A^2 - v_B^2 + 2v_A.v_B \cos\left(180^0 + \theta\right)}$, $\tan^{-1}\left(\dfrac{v_B \sin\theta}{v_A + v_B \cos\theta}\right)$

34. A rat is moving down the slant of a wedge of angle of inclination $\theta$, with a velocity $\vec{v}$, as shown in the figure. If the wedge moves towards left with a velocity $\vec{u}$, find
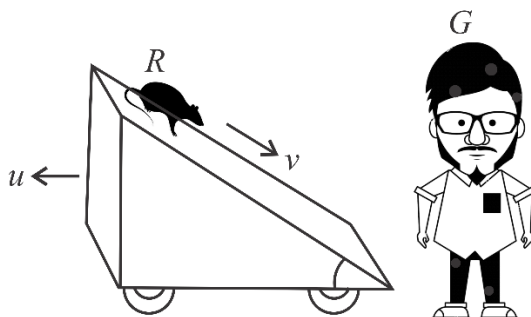


1) velocity of the rat relative to ground,

2) Value of $\theta$, if the rate moves vertically downward relative to an observer G fixed with the ground

1) $\sqrt{u^2 + v^2}$ , $\theta = \cos^{-1}\dfrac{u}{v}$ 

2) $\sqrt{u^2 + v^2}$, $\theta = \cos^{-1}\dfrac{v}{u}$

3) $\sqrt{u^2 - v^2}$, $\theta = \cos^{-1}\dfrac{v}{u}$ 

4) $\sqrt{u^2 + v^2 - 2uv\cos\theta}$ , $\theta = \cos^{-1}\dfrac{u}{v}$

35. A truck is moving a constant velocity of u =54 km/hr. In what direction should a stone be projected up with a velocity of v = 30 m/s, from the floor of the truck, so as to appear at right angles to the truck, for a person standing on earth?



*v = 20 m/s*

θ

*u = 15 m/s*

1) $\theta = 120^0$ 
2) $\theta = 60^0$ 
3) $\theta = 45^0$ 
4) $\theta = 53^0$
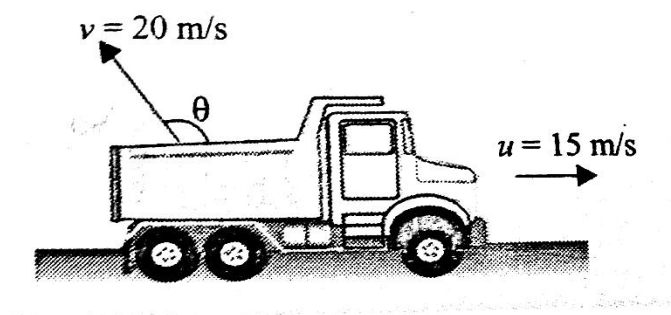
36. A block slips along an incline of a wedge. Due to the reaction of the block on the wedge, it slips backwards. An observer on the wedge will see the block moving straight down the incline. To find the absolute velocity of the block

1) $\dfrac{v\sin\theta}{v\cos\theta - V}$ 

2) $\dfrac{v\cos\theta}{v\cos\theta - V}$ 

3) $\dfrac{v\cos\theta}{v\cos\theta + V}$ 

4) $\dfrac{v\cot\theta}{v\cos\theta + V}$

37. A political party has to start its procession in an area where wind is blowing at a speed of $30\sqrt{2}$ km h$^{-1}$ and party flags on the cars are fluttering along north-east direction. If the procession starts with a speed of 40 kmph$^{-1}$ towards north, find the direction of flags on the cars.

1) $\theta = \tan^{-1}(2/3)\,N - W$ 

2) $\theta = \tan^{-1}(1/3)\,S \text{ of } E$

3) $\theta = \tan^{-1}(2/3)\,S \text{ of } E$ 

4) $\theta = \tan^{-1}(2/3)\,N \text{ of } W$

38. A bird is flying due east with a velocity of 4 ms$^{-1}$ . The wind starts to blow with a velocity of 3 ms$^{-1}$ due north. What is the magnitude of relative velocity of bird w.r.t wind? Find out its direction also

1) $5ms^{-1}; \beta = \tan^{-1}\left(\dfrac{3}{4}\right)$ from east toward south 

2) $4ms^{-1}; \beta = \tan^{-1}\left(\dfrac{3}{4}\right)$ from east toward south

3) $3ms^{-1}; \beta = \tan^{-1}\left(\dfrac{3}{4}\right)N - W$ 

4) $5ms^{-1}; \beta = \sin^{-1}\left(\dfrac{3}{4}\right)$ from east toward south

39. A river is flowing with a speed of 1 kmh$^{-1}$ . A swimmer wants to go to point C starting from A . He swims with a speed of 5 kmh$^{-1}$ at an angle $\theta$ w.r.t the river flow. If AB = BC = 400m, at what angle with the river bank should the swimmer swim?

1) $\theta = 53^0$        2) $\theta = 35^0$        3) $\theta = 40^0$    4) $\theta = 45^0$
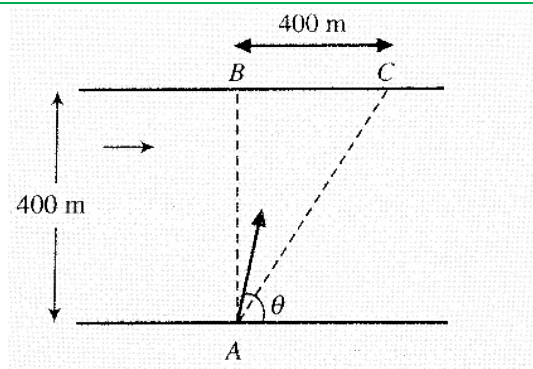
40. A person standing on a road has to hold his umbrella at $60^0$ with the vertical to keep the rain away. He throws the umbrella and starts running at 20 ms$^{-1}$ . He find that rain drops are hitting his head vertically. Find the speed of the rain drops with respect to (a) the road and (b) the moving person.

1) $\dfrac{40}{\sqrt{3}}$ m/sec, $\dfrac{20}{\sqrt{3}}$ m/sec        2) $\dfrac{30}{\sqrt{3}}$ m/sec, $\dfrac{10}{\sqrt{3}}$ m/sec

3) $\dfrac{30}{\sqrt{3}}$ m/sec, $\dfrac{20}{\sqrt{3}}$ m/sec        4) $30$ m/sec, $20$ m/sec

41. An aeroplane pilot wishes to fly due west. A wind of 100 kmh$^{-1}$ is blowing towards south.

a) If the speed of the plane (its speed in still air) is 300 kmh$^{-1}$, in which direction should the pilot head?

b) What is the speed of the plane with respect to ground? Illustrate with a vector diagram

1) $\theta = \cos^{-1}\left(\dfrac{1}{3}\right), 100\sqrt{2}\text{kmh}^{-1}$        2) $\theta = \sin^{-1}\left(\dfrac{2}{3}\right), 200\sqrt{2}\text{kmh}^{-1}$

3) $\theta = \sin^{-1}\left(\dfrac{1}{3}\right), 200\sqrt{2}\text{kmh}^{-1}$        4) $\theta = \sin^{-1}\left(\dfrac{1}{3}\right), 100\sqrt{2}\text{kmh}^{-1}$

42. Ship A is travelling with a velocity of 5 km h$^{-1}$ due east. A second ship is heading $30^0$ east of north. What should be the speed of second ship if it is to remain always due north with respect to the first ship?

1) 10 km h$^{-1}$        2) 9 km h$^{-1}$        3) 8 km h$^{-1}$        4) 7 km h$^{-1}$

43. Rain, driven by the wind, falls on a railway compartment with a velocity of 20 ms$^{-1}$ at an angle of $30^0$ to the vertical. The train moves, along the direction of wind flow, at a speed of 108 kmh$^{-1}$. Determine the apparent velocity of rain for a person sitting in the train?

1) $20\sqrt{7}\text{ms}^{-1}$        2) $10\sqrt{7}\text{ms}^{-1}$        3) $15\sqrt{7}\text{ms}^{-1}$        4) $10\sqrt{7}\text{km h}^{-1}$

44. The ratio of the distance carried away by the water current, downstream, in crossing a river, by a persons, making same angle with downstream and upstream is 2:1. The ratio of the speed of person to the water current cannot be less than

1) 1/3        2) 4/5        3) 2/5        4) 4/3

45. Rain appears to fall vertically to a man walking at 3 km h$^{-1}$ but when he changes his speed to double, the rain appears to fall at $45^0$ with vertical. Study the following statements and find which of them are correct.

i. Velocity of rain is $2\sqrt{3}$ km h$^{-1}$

ii. The angle of fall of rain (with vertical) is $\theta = \tan^{-1}\left(\dfrac{1}{\sqrt{2}}\right)$

iii. The angle of fall of rain (with vertical) is $\theta = \sin^{-1}\left(\dfrac{1}{\sqrt{2}}\right)$

iv. Velocity of rain is $3\sqrt{2}$ kmh$^{-1}$

1) statements (i) and (ii) are correct        2) statements (i) and (iii)are correct

3) Statements (iii) and (iv)are correct        4) statements (ii) and (iv)are correct

46. Raindrops are hitting the back of a man walking at a speed of 5 km h$^{-1}$ if he now starts running in the same direction with a constant acceleration, the magnitude of the velocity of the rain with respect to him will

1) Gradually increase        2) gradually decrease

3) first decrease then increase        4) first increase then decrease

# Topic 2: Projectile Motion

47. Which one is the largest when the height attained by the projectile is the greatest?
(1) Range        (2) Time of flight        (3) Angle of projectile with the vertical        (4) None of these

48. Two projectiles A and B are thrown with the same speed but angles are 40º and 50º with the horizontal. Then
(1) A will fall earlier        (2) B will fall earlier
(3) both will fall at the same time        (4) None of these

49. A body is projected, making an acute angle with the horizontal. If angle between velocity $\vec{v}$ and acceleration $\vec{g}$ is $\theta$, then

1) $\theta = 90^0$        2) $\theta = 0^0$        3) $90^0 < \theta < 0^0$        4) $0^0 < \theta < 180^0$

50. A stone is thrown with a velocity u making an angle $\theta$ with the horizontal. The horizontal distance covered by its fall to ground is maximum when the angle $\theta$ is equal to

1) $0^0$        2) $30^0$        3) $45^0$        4) $90^0$

51. If range is double the maximum height of a projectile, then $\theta$ is
1) $\tan^{-1}$        2) $\tan^{-1}1/4$        3) $\tan^{-1}1$        4) $\tan^{-1}2$

52. For angles of projection of a projectile $\left(45^0 - \theta\right)$ and $\left(45^0 + \theta\right)$, the horizontal ranges described by the projectile are in the ratio of
1) 1:3        2) 1:2        3) 2:1        4) 1:1

53. A person can throw a stone to a maximum distance of h metre. The maximum distance to which he can throw the stone is
1) h        2) h/2        3) 2h        4) 3h

54. Two balls are projected at an angle $\theta$ and $(90^0 - \theta)$ to the horizontal with the same speed. The ratio of their maximum vertical heights is
   1) 1:1
   2) $\tan\theta : 1$
   3) $1 : \tan\theta$
   4) $\tan^2\theta : 1$

55. A body is thrown with a velocity of 9.8 ms$^{-1}$ making an angle of $30^0$ with the horizontal. It will hit the ground after a time
   1) 3.0s
   2) 2.0s
   3) 1.5s
   4) 1s

56. The velocity of projection of a body is increased by 2%.Other factors remaining unchanged, what will be the percentage change in the maximum height attained?
   (1) 1%
   (2) 2 %
   (3) 4 %
   (4) 8 %

57. A particle moves in a plane with a constant acceleration in a direction different from the initial velocity. The path of the particle is a/an
   (1) straight line
   (2) arc of a circle
   (3) parabola
   (4) ellipse

58. A particle reaches its highest point when it has covered exactly one half of its horizontal range. The corresponding point on the displacement-time graph is characterized by
   (1) negative slope and zero curvature
   (2) zero slope and negative curvature
   (3) zero slope and positive curvature
   (4) positive slope and zero curvature

**59.** The range of a particle when launched at an angle of 15° with the horizontal is 1.5 km. What is the range of the projectile when launched at an angle of 45° to the horizontal?
   (1) 1.5 km
   (2) 3.0 km
   (3) 6.3 km
   (4) 0.75 km

60. A body is thrown horizontally with a velocity $\sqrt{2gh}$ from the top of a tower of height h. It strikes the level ground through the foot of the tower at a distance x from the tower. The value of x is
   1) gh
   2) gh/2
   3) 2h
   4) 2gh/3

61. A projectile is thrown at an angle of $40^0$ with the horizontal and its range is R$_1$. Another projectile is thrown at an angle $40^0$ with the vertical and its range is R$_2$ What is the relation between R$_1$ and R$_2$
   1) $R_1 = R_2$
   2) $R_1 = 2R_2$
   3) $2R_1 = R_2$
   4) $RR_1 = 4R_2 /$

62. The equation of a projectile is $y = \sqrt{3}x - \dfrac{gx^2}{2}$ the angle of projection is given by
   1) $\tan\theta = \dfrac{1}{\sqrt{3}}$
   2) $\tan\theta = \sqrt{3}$
   3) $\dfrac{\pi}{2}$
   4) zero

63. A gun fires two bullets at $60^0$ and $30^0$ with horizontal. The bullets strike at some horizontal distance. The ratio of maximum height for the two bullets is in the ratio
   (1) 2 : 1
   (2) 3 : 1
   (3) 4 : 1
   (4) 1 : 1

64. A projectile thrown with a speed v at an angle $\theta$ has a range R on the surface of earth. For same v and $\theta$, its range on the surface of moon will be $\left[ g_{moon} = \dfrac{g_{Earth}}{6} \right]$
   1) R/6
   2) R
   3) 6R
   4) 36R

65. An object is projected with a velocity of 20m/s making an angle of $45^0$ with horizontal. The equation for the trajectory is $h = Ax - Bx^2$ wher h is height, x is horizontal distance. A and B are constant. There ration A:B is (g =10ms$^{-2}$)
   1) 1:5
   2) 5:1
   3) 1:40
   4) 40:1

66. A particle is projected with a velocity $v$ such that its range on the horizontal plane is twice the greatest height attained by it. The range of the projectile is (where g is acceleration due to gravity)
   1) $\dfrac{4v^2}{5g}$
   2) $\dfrac{4g}{5v^2}$
   3) $\dfrac{v^2}{g}$
   4) $\dfrac{4v^2}{\sqrt{5}g}$

67. A ball is thrown from the ground with a velocity of $20\sqrt{3}$ m/s making an angle of 60º with the horizontal. The ball will be at a height of 40 m from the ground after a time t equal to(g = 10ms$^{-2}$)

   1) $\sqrt{2}$ sec     2) $\sqrt{3}$ sec          3) 2 sec          4) 3 sec

68. A bomb is dropped on an enemy post by an aeroplane flying horizontally with a velocity of 60 km h$^{-1}$ and at a height of 490 m. At the time of dropping the bomb, how far the aeroplane should be from the enemy post so that the bomb may directly hit the target ?

   1) $\dfrac{400}{3}$ m          2) $\dfrac{500}{3}$ m          3) $\dfrac{1700}{3}$ m          4) 498m

69. A body is projected horizontally from a point above the ground and motion of the body is described by the equation $x = 2t, y = 5t^2$ where x, and y are horizontal and vertical coordinates in metre after time t. The initial velocity of the body will be

   1) $\sqrt{29}$ m/s horizontal          (2) 5 m/s horizontal     (3) 2 m/s vertical          (4) 2 m/s horizontal

70. A projectile thrown with velocity v making angle $\theta$ with vertical, gains maximum height H in the time for which the projectile remains in air, the time period is

   1) $\sqrt{H\cos\theta/g}$          2) $\sqrt{2H\cos\theta/g}$          3) $\sqrt{4H/g}$          4) $\sqrt{8H/g}$

71. A person aims a gun at a bird from a point at a horizontal distance of 100 m. If the gun can impact a speed of 500 ms$^{-1}$ to the bullet. At what height above the bird must he aim his gun in order to hit it? (g = 10ms$^{-2}$)

   1) 10.4 cm 2) 20.35 cm 3) 50 cm 4) 100 cms

72. A man standing on the roof of a house of height h throws one particle vertically downwards and another particle horizontally with the same velocity u. The ratio of their velocities when they reach the earth's surface will be

   1) $\sqrt{2gh + u^2} : u$          2) 1:2          3) 1:1          4) $\sqrt{2gh + u^2} : \sqrt{2gh}$

73. If V1 is velocity of a body projected from the point A and V2 is the velocity of a body projected from point B which is vertically below the highest point C. if both the bodies collide, then

   1) $V_1 = \dfrac{1}{2}V_2$          2) $V_2 = \dfrac{1}{2}V_1$          3) $V_1 = V_2$          4) Two bodies can't collide

74. A projectile can have the same range R for two angles of projection. It t1 and t2 be the times of flight in the two cases, then what is the product of two times of flight?

   1) $t_1t_2 \propto R^2$          2) $t_1t_2 \propto R$          3) $t_1t_2 \propto \dfrac{1}{R}$          4) $t_1t_2 \propto \dfrac{1}{R^2}$

75. A ball rolls off to the top of a staircase with a horizontal velocity u m/s. If the steps are h metre high and b metre wide, the ball will hit the edge of the nth step, if

   1) $n = \dfrac{2hu}{gb^2}$          2) $n = \dfrac{2hu^2}{gb}$          3) $n = \dfrac{2hu^2}{gb^2}$          4) $n = \dfrac{hu^2}{gb^2}$

76. A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is *v*, the total area around the fountain that gets wet is

   1) $\pi\dfrac{v^4}{g^2}$          2) $\pi\dfrac{v^4}{2g^2}$          3) $\pi\dfrac{v^2}{g^2}$          4) $\pi\dfrac{v^2}{g}$

77. A ball projected from ground at an angle of 45° just clears a wall in front. If point of projection is 4 m from the foot of wall and ball strikes the ground at a distance of 6 m on the other side of the wall, the height of the wall is :

   1) 4.4 m 2) 2.4 m 3) 3.6 m 4) 1.6 m

78. A boy can throw a stone up to a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone up to will be

   1) $20\sqrt{2}$m      2) 10m      3) $10\sqrt{2}$m      4) 20m

79. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)$m/s its velocity (in m/s) at point B is

   1) $-2\hat{i}+3\hat{j}$      2) $2\hat{i}-3\hat{j}$      3) $2\hat{i}+3\hat{j}$      4) $-2\hat{i}-3\hat{j}$

80. If $t_m$ is the time taken by a projectile to achieve the maximum height, then the total time of flight $t_f$ related to $t_m$ as

   1) $t_m = 2T_f$      2) $t_f = t_m$      3) $T_f = 2t_m$      4) none of these

# Topic 3: Circular Motion

81. In uniform circular motion
   (1) both velocity and acceleration are constant
   (2) acceleration and speed are constant but velocity changes
   (3) both acceleration and velocity change
   (4) both acceleration and speed are constant

82. The length of second's hand in a watch is 1 cm. The change in velocity of its tip in 15 seconds is:

   1) zero      2) $\dfrac{\pi}{30\sqrt{2}}$cm/s      3) $\dfrac{\pi}{30}$cm/s      4) $\dfrac{\pi\sqrt{2}}{30}$cm/s

83. An aircraft executes a horizontal loop of radius 1.00 km with a stedy speed of 900 km/h. The ratio of centripetal acceleration to acceleration due to gravity is $\left[g=9.8m/s^2\right]$

   1) 6.38      2) 9.98      3) 11.33      4) 12.13

84. A particle moves in a circle of radius 30 cm. Its linear speed is given by : V = 2t, where t in second and v in m/s. Find out its radial and tangential acceleration at t = 3 sec respectively.

   1) $220m/sec^2, 50m/sec^2$      2) $110m/sec^2, 5m/sec^2$

   3) $120m/sec^2, 2m/sec^2$      4) $110m/sec^2, 10m/sec^2$

85. A particle P is moving in a circle of radius 'a' with a uniform speed v. C is the centre of the circle and AB is a diameter. When passing through B the angular velocity of P about A and C are in the ratio:
   (1) 1 : 1      (2) 1 : 2      (3) 2 : 1      (4) 4 : 1

86. A particle moves in a circle of radius 25 cm at two revolutions per second. The acceleration of the particle in meter per second$^2$ is
   (1) $\pi^2$      (2) $8\pi^2$      (3) $4\pi^2$      (4) $2\pi^2$

87. A wheel rotates with constant acceleration of 2.0 rod/s$^2$, if the wheel starts from rest the number of revolutions it makes in the first ten seconds will be approximately
   (1) 32      (2) 24      (3) 16      (4) 8

88. A car is moving along a circular path of radius 500 m with a speed of 30 m/s. If at some instant, its speed increases at the rate of 2 m/s2, then at that instant the magnitude of resultant acceleration will be:
   (1) 4.7 m/s$^2$      (2) 3.8 m/s$^2$      (3) 3 m/s2      (4) 2.7 m/s2

89. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds in every circular loop. The average velocity and average speed for each circular loop respectively, is
   (1) 0, 10 m/s      (2) 10 m/s, 10 m/s      (3) 10 m/s, 0      (4) 0, 0

90. A particle describes uniform circular motion in a circle of radius 2 m, with the angular speed of 2 rad s$^{-1}$.

    The magnitude of the change in its velocity in $\dfrac{\pi}{2}$ s is

    (1) 0 ms$^{-1}$          (2) 2 2 ms$^{-1}$          (3) 8 ms$^{-1}$          (4) 4 ms$^{-1}$

# NEET PREVIOUS YEARS QUESTIONS

1. The position vector of a particle $\vec{R}$ as a function of time is given by $\vec{R} = 4\sin(2\pi t)\hat{i} + 4\cos(2\pi t)\hat{j}$

   Where R is in meter, t in seconds and $\hat{i}$ and $\hat{j}$ denote unit vectors along x-and y-directions, respectively. Which one of the following statements is wrong for the motion of particle? **(2015)**

   (1) Magnitude of acceleration vector is $\dfrac{v^2}{R}$, where v is the velocity of particle

   (2) Magnitude of the velocity of particle is 8 meter/second

   (3) Path of the particle is a circle of radius 4 meter.     (4) Acceleration vector is along $-\vec{R}$

2. A particle is moving such that its position coordinate (x, y) are (2m, 3m) at time t = 0 (6m, 7m) at time t = 2 s and (13m, 14m) at time t = 5s.

   Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5s is                  **(2014)**

   1) $\dfrac{1}{5}\left(13\hat{i}+14\hat{j}\right)$    2) $\dfrac{7}{3}\left(\hat{i}+\hat{j}\right)$    3) $2\left(\hat{i}+\hat{j}\right)$    4) $\dfrac{11}{5}\left(\hat{i}+\hat{j}\right)$

3. The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by :    **[NEET-2019]**

   (1) 30° west          (2) 0°          (3) 60° west          (4) 45° west

4. A particle starting from rest, moves in a circle of radius 'r'. It attains a velocity of $V_0$ m/s in the n$^{th}$ round. Its angular acceleration will be :-          **[NEET – 2019 (ODISSA)]**

   1) $\dfrac{V_0}{n} rad/s^2$    2) $\dfrac{V_0^2}{2\pi nr^2} rad/s^2$    3) $\dfrac{V_0^2}{4\pi nr^2} rad/s^2$    4) $\dfrac{V_0^2}{4\pi nr} rad/s^2$

5. Two bullets are fired horizontally and simultaneously towards each other from roof tops of two buildings 100 m apart and of same height of 200m with the same velocity of 25 m/s. When and where will the two bullets collide. (g =10 m/s$^2$)          **[NEET – 2019 (ODISSA)]**

   (1) after 2s at a height 180 m          (2) after 2s at a height of 20 m

   (3) after 4s at a height of 120 m          (4) they will not collide

6. A particle moving in a circle of radius R with a uniform speed takes a time T to complete one revolution. If this particle were projected with the same speed at an angle '$\theta$' to the horizontal, the maximum height attained by it equals 4R . The angle of projection $\theta$, is then given by : **[NEET-2021]**

   1. $\theta = \cos^{-1}\left(\dfrac{\pi^2 R}{gT^2}\right)^{1/2}$   2. $\theta = \sin^{-1}\left(\dfrac{\pi^2 R}{gT^2}\right)^{1/2}$   3. $\theta = \sin^{-1}\left(\dfrac{2gT^2}{\pi^2 R}\right)^{1/2}$      4. $\theta = \cos^{-1}\left(\dfrac{gT^2}{\pi^2 R}\right)^{1/2}$

7. A car starts from rest and accelerates at 5 m/s$^2$. At t = 4 s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6s?        **[NEET-2021]**

   (Take g = 10 m/s$^2$)

1) 20 m/s, 0        2) $20\sqrt{2}$ m/s, 0    3) $20\sqrt{2}$ m/s, 10 m/s$^2$    4) 20 m/s, 5 m/s$^2$

8. The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration in rad/s$^2$ is        **[NEET-2022]**

1) $2\pi$        2) $4\pi$        3) $12\pi$        4) $104\pi$

9. The displacement – time graphs of two moving particles make angles of $30^0$ and $45^0$ with the x – Axis as shown in the figure. The ratio of their respective velocity is        **[NEET-2022]**
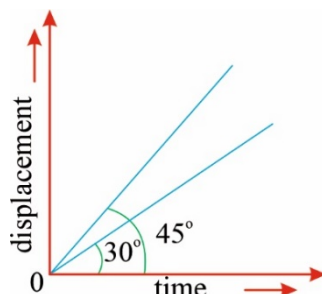


1) $\sqrt{3}:1$        2) $1:1$        3) $1:2$        4) $1:\sqrt{3}$

10. A ball is projected with a velocity, 10 ms$^{-1}$, at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be :        **[NEET-2022]**

1) Zero        2) $5\sqrt{3}\,ms^{-1}$        3) $5\,ms^{-1}$        4) $10\,ms^{-1}$

## NCERT LINE BY LINE QUESTIONS – ANSWERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. 3 | 2. 2 | 3. 1 | 4. 3 | 5. 3 | 6. 1 | 7. 2 | 8. 2 | 9. 4 | 10. 1 |
| 11. 2 | 12. 2 | 13. 3 | 14. 4 | 15. 2 | 16. 3 | 17. 1 | 18. 4 | 19. 3 | 20. 2 |
| 21. a | 22. a | 23. d | 24. a | 25. c | 26. b | 27. b | 28. a | 29. b | 30. A |
| 31. a | 32. c | 33. c | 34. a | 35. a | 36. a | 37. d | 38. d | 39. b | 40. c |
| 41. b | 42. c | 43. a | 44. a | 45. a | 46. a | 47.a,d | 48. b | 49. c | 50. B |
| 51. d | 52. c | 53. a | 54. c | 55. c | 56. a | 57. a | 58. d | 59. a | 60. c |

## TOPIC WISE PRACTICE QUESTIONS - ANSWERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) 3 | 2) 2 | 3) 2 | 4) 1 | 5) 4 | 6) 1 | 7) 4 | 8) 3 | 9) 4 | 10) 1 |
| 11) 3 | 12) 1 | 13) 1 | 14) 4 | 15) 1 | 16) 2 | 17) 3 | 18) 3 | 19) 2 | 20) 1 |
| 21) 2 | 22) 3 | 23) 1 | 24) 2 | 25) 2 | 26) 2 | 27) 4 | 28) 2 | 29) 4 | 30) 1 |
| 31) 3 | 32) 3 | 33) 1 | 34) 4 | 35) 1 | 36) 1 | 37) 2 | 38) 1 | 39) 1 | 40) 1 |
| 41) 3 | 42) 1 | 43) 2 | 44) 1 | 45) 3 | 46) 3 | 47) 2 | 48) 1 | 49) 4 | 50) 3 |
| 51) 4 | 52) 4 | 53) 2 | 54) 4 | 55) 4 | 56) 3 | 57) 3 | 58) 3 | 59) 2 | 60) 3 |
| 61) 1 | 62) 2 | 63) 2 | 64) 3 | 65) 4 | 66) 1 | 67) 3 | 68) 2 | 69) 4 | 70) 4 |
| 71) 2 | 72) 3 | 73) 2 | 74) 2 | 75) 3 | 76) 1 | 77) 2 | 78) 4 | 79) 2 | 80) 3 |
| 81) 3 | 82) 4 | 83) 1 | 84) 3 | 85) 2 | 86) 3 | 87) 3 | 88) 4 | 89) 1 | 90) 3 |

## NEET PREVIOUS YEARS QUESTIONS-ANSWERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) 2 | 2) 4 | 3) 1 | 4) 3 | 5) 1 | 6) 3 | 7) 3 | 8) 2 | 9) 4 | 10) 2 |

## TOPIC WISE PRACTICE QUESTIONS - SOLUTIONS

1.  3) With respect to the an on ground, the stone has horizontal velocity (equal to that of the truck) as well as vertical velocity. So, it would appear to move along a parabolic path.

2.  2) The relative acceleration of one particle w.r.t to the other is zero, so relative velocity is constant in magnitude and direction.

3.  (2) The horizontal component of rain should have same direction and magnitude as the velocity of man.

4.  (1) Horizontal components of their velocities are equal so Q views P to be flitting vertically downwards.

5.  4) $\vec{v}_B = \vec{v}_{BA} + \vec{v}_A = \left(5\hat{i} + 12\hat{j}\right) + \left(3\hat{i} - 4\hat{j}\right)$

    $\vec{v}_B = 8\hat{i} + 8\hat{j}$

6.  1) $\overrightarrow{V_b} = 3\hat{i} + 4\hat{j}, \overrightarrow{V_w} = -3\hat{i} - 4\hat{j}$

    $\overrightarrow{V_{b/w}} = \overrightarrow{V_b} - \overrightarrow{V_w} = 6\hat{i} + 8\hat{j}$

7.  4) $\vec{v}_A = 40\hat{j}, \vec{v}_B = 30\hat{i}$

    $\vec{v}_{B/A} = \vec{v}_B - \vec{v}_A = 30\hat{i} - 40\hat{j}$

    $\left|\vec{v}_{B/A}\right| = \sqrt{30^2 + 40^2} = 50 \, \text{km/h}$

8.  3) $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A = 80 - 65 = 15 \text{km}/\text{hr}$

$\left[ \because \text{both are moving in the same direction} \right]$

9.  4)

10. 1) $\vec{V}_A = 10\left(-\hat{i}\right)$ and $\vec{V}_B = 10\left(\hat{j}\right)$

$\vec{V}_B = 10\left(\hat{j}\right) + 10\hat{i} = 10\sqrt{2}\,\text{km}/\text{h}$

Distance $OB = 100\cos 45^0 = 50\sqrt{2}\,\text{km}$
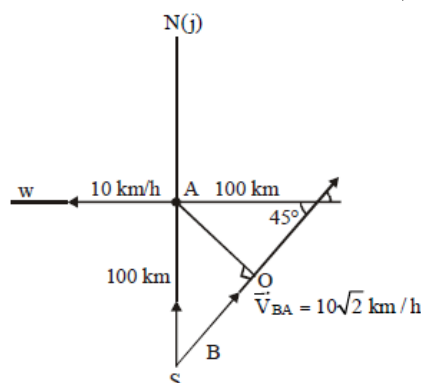


Time taken to reach the shortest distance between A and B $= \dfrac{OB}{V_{BA}} = \dfrac{50\sqrt{2}}{10\sqrt{2}} = 5\text{h}$

11. 3) Relative velocity $= (2i + 3j) - (-2i - 3j) = 4i + 6j$ .

12. 1) Speed along the shortest path $= \dfrac{1}{20/60} = 3\text{km}/\text{hr}$

Speed of water $v = \sqrt{6^2 - 3^2} = 5\text{km}/\text{hr}$

13. 1) $\vec{v}_{SB} = v\hat{j} = \vec{v}_s + 3\hat{i}$

$\vec{v}_s = v\hat{j} - 3\hat{i}$ and $v = \dfrac{100}{50} = 2\text{m}/\text{s}$

$\therefore \left|\vec{v}_s\right| = \sqrt{v^2 + (3)^2} = \sqrt{2^2 + 9} = \sqrt{13}\,\text{m}/\text{s}$

Drift $= 50 \times 3 = 150\text{m}$

14. 4)

15. 1) $\vec{v}_1 = 50\text{km h}^{-1}$ due North ;

$\vec{v}_2 = 50\text{km h}^{-1}$ due West

Angle between $\vec{v}_1$ and $\vec{v}_2 = 90^0$

$-\vec{v}_1 = 50\text{kmh}^{-1}$ due south

$\therefore$ change in velocity $= \left|\vec{v}_2 - \vec{v}_1\right| = \left|\vec{v}_2 + \left(-\vec{v}_1\right)\right| = \sqrt{v_2^2 + v_1^2} = \sqrt{50^2 + 50^2} = 70.7\text{km}/\text{h}$

16. 2) The two cars (say A and B) are moving with same velocity, the relative velocity of one (say B) with respect to the other A, $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A = v - v = 0$ So the relative separation between them ($= 5$ km) always remains the same. Now if the velocity of car (say C) moving in opposite direction to A and B, is $\vec{v}_c$ r relative to ground then the velocity of car C relative to A and B will be $\vec{v}_{rel} = \vec{v}_c - \vec{v}$ But as $\vec{v}$ is opposite to $v_c$

So, $\vec{v}_{rel} = \vec{v}_c - \left(-30\right) = \left(v_c + 30\right)\text{km}/\text{hr}$

So, the time taken by it to cross the cars A and B $t = \dfrac{d}{v_{rel}} \Rightarrow \dfrac{4}{60} = \dfrac{5}{v_c + 30} \Rightarrow v_c = 45\text{km}/\text{hr}$

17. 3)

$$\vec{v}_c = -5\hat{j}$$
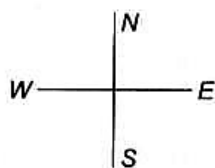


$$v_{a,b,c} = -2\sqrt{6}\,\hat{i}$$

$$\vec{v}_b = \vec{v}_{bc} + \vec{v}_c = -2\sqrt{6}\hat{i} - 5\hat{j}$$

$$|\vec{v}_b| = \sqrt{4 \times 6 + 25} = 7 \text{ m/s}$$

18. 3) $\vec{v}_w = 20\hat{i}, \vec{v}_c = 20\hat{i}$ here we have to look for velocity of wind w.r.t car. So

$$\vec{v}_{w/C} = \vec{v}_w - \vec{v}_c = 20\hat{i} - 20\hat{j}$$

This is in south-east direction

19. 2) Horizontal component of rain's velocity will be equal to velocity of wind which is 2 m/s in north direction. If cyclist goes towards north with velocity 2 m/s, then w.r.t him rain's horizontal component of velocity will be zero, and he will see only vertical component.

20. 1) $v_c = 45 \text{km/h} = \dfrac{25}{2} \text{m/s}$
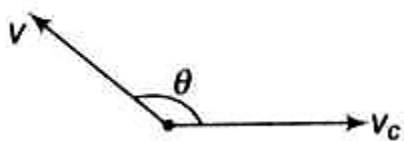


For the resultant motion to be upwards.

$$v\cos\theta + v_c = 0$$

$$\cos\theta = -\frac{v_c}{v} = -\frac{25/2}{25} = -\frac{1}{2} \Rightarrow \theta = 120^0$$

21. 2) $\vec{v}_A = \vec{v}_B = v\left(\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}\right); \vec{v}_B - \vec{v}_C = v\left(\dfrac{-\hat{i}+\hat{j}}{\sqrt{2}}\right)$

Adding: $\Rightarrow \vec{v}_A - \vec{v}_C = \dfrac{2v}{\sqrt{2}}\hat{j} \Rightarrow \vec{v}_C - \vec{v}_A = -\sqrt{2}v\hat{j} = \sqrt{2}v\left(-\hat{j}\right)$

So C will be moving towards south as seen by A. or $\alpha_P > 10 \text{m/s}^2$

22. 3) In order to arrive at the opposite bank, the boast should start at an angle $\theta$ with north such that sin $\theta = \dfrac{4}{8}$ or $\theta = 30^0$. The real velocity of boat will be

$$v = \sqrt{8^2 - 4^2} = \sqrt{48}, \theta = 30^0 \text{ W of N}$$



23. 1) Let v be the river velocity and u the velocity of swimmer in still water. Then

$$t_1 = 2\left(\frac{W}{\sqrt{u^2 - v^2}}\right)$$

$$t_2 = \frac{W}{u+v} + \frac{W}{u-v} = \frac{2uW}{u^2 - v^2} \text{ and } t_3 = \frac{2W}{u}$$

Now we can see that $t_1^2 = t_2 t_3$

24.  2) $t = \dfrac{d}{\sqrt{v^2 - u^2}}$
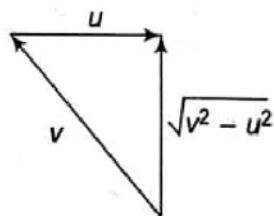


$$\Rightarrow \frac{15}{60} = \frac{1}{\sqrt{5^2 - u^2}} \Rightarrow u = 3\,km/h$$

25.  2) $t = \dfrac{d}{\sqrt{v^2 - u^2}} \Rightarrow 5 = \dfrac{60}{\sqrt{v^2 - 5^2}} \Rightarrow v = 13\,m/s$

26.  2)
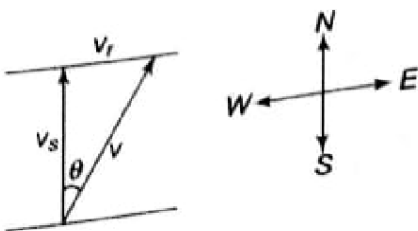


Here, velocity of water flowing in river, $n_r = 3\,ms^{-1}$ velocity of swimmer in still water, $n_s = 4\,ms^{-1}$ from figure, The resultant velocity of the swimmer is

$$v = \sqrt{v_s^2 + v_r^2} = \sqrt{(4)^2 + (3)^2} = \sqrt{25} = 5\,ms^{-1}$$

27.  4) Time to cross river $T = \dfrac{336}{1} = 336\,sec$
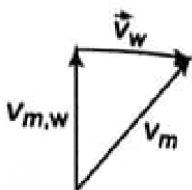


28.  2) $\sin\theta = \dfrac{\sqrt{3}}{2} \Rightarrow \theta = 60^0$

Hence $150^0$ with water current
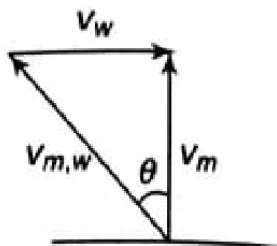
29. 4)
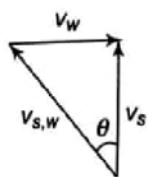


In this case As $v_w > v_{sw}$

As $\sin\theta$ cannot be greater than 1, he cannot reach directly opposite bank in this way.

30. 1)
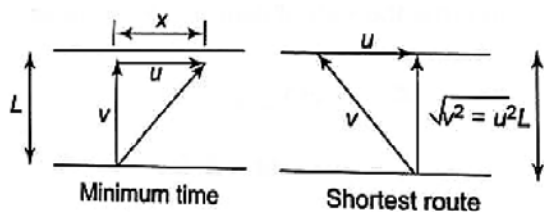


$$10 = \frac{L}{v} \quad\ldots\ldots\ldots\ldots(i)$$

$$12.5 = \frac{L}{\sqrt{v^2 - u^2}} = \frac{L}{v\sqrt{1 - u^2/v^2}} \quad\ldots\ldots(ii)$$

From (i) and (ii) $\dfrac{1}{12.5} = \dfrac{L}{v} \times \dfrac{v\sqrt{1 - u^2/v^2}}{L}$

$$\frac{4}{5} = \sqrt{1 - \frac{12^2}{v^2}}$$

$$\frac{16}{25} = 1 - \frac{12^2}{v^2} \Rightarrow \frac{12^2}{v^2} = 1 - \frac{16}{25} = \frac{9}{25}$$

$$\frac{12}{v} = \frac{3}{5} \Rightarrow v = \frac{12 \times 5}{3} = 20 = m/s$$

31. 3) $\vec{v}_{r/m} = \vec{v}_r - \vec{v}_m$
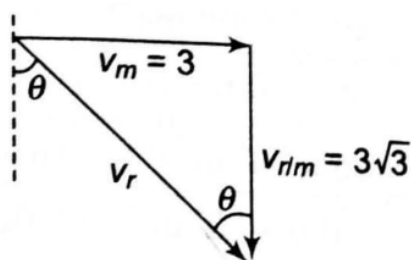


$\vec{v}_r = \vec{v}_{r/m} + \vec{v}_m$

$$\tan\theta = \frac{3}{3\sqrt{3}} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^0$$

32. 3)
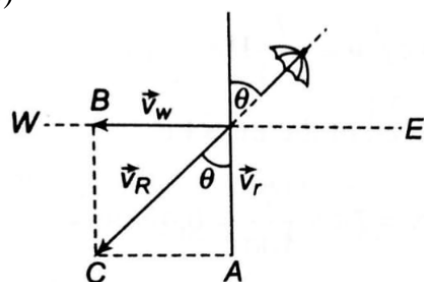
The velocity of the rain and the wind are represented by the vectors $\vec{v}_r$ and $\vec{v}_w$ as shown in the figure. To protect himself from the rain the boy should hold his umbrella in the direction of resultant velocity $\vec{v}_R$. If $\theta$ is the angle which resultant velocity $\vec{v}_R$ makes with the vertical, then

$$\tan\theta = \frac{v_w}{v_r} = \frac{12}{35} \text{ or } t\theta = \tan^{-1}\left(\frac{12}{35}\right)$$

33.  1) Direction of motion of car A as seen from car B



For driver of car B, car A appears to move in this direction
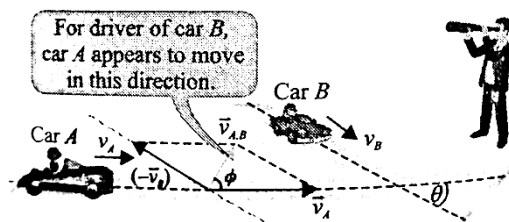
Car B

Car A

Velocity of car A as seen from car B

$$\vec{v}_{AB} = \vec{v}_A - \vec{v}_B = \vec{v}_A + \left(-\vec{v}_B\right)$$

Magnitude : $\left|\vec{v}_{A,B}\right| = \sqrt{v_A^2 + v_B^2 + 2v_A.v_B.\cos\left(180^0 - \theta\right)}$

Direction: $\tan\phi = \dfrac{v_B\sin\left(180^0 - \theta\right)}{v_A + v_B\cos\left(180^0 - \theta\right)} \Rightarrow \phi = \tan^{-1}\left(\dfrac{v_B\sin\theta}{v_A - v_B\cos\theta}\right)$

34.  4)

35.  1)

36.  1) We know that

$$\vec{V}_{m/M} = \vec{V}_m - \vec{V}_M \Rightarrow \vec{V}_m = \vec{V}_{m/M} + \vec{V}_M$$

Not that a single subscript implies absolute velocity .The absolute velocity of block is the vector sum of its velocity relative to the wedge and velocity of wedge relative to ground. The absolute velocity of block (ground reference frame) is shown in the vector diagram given in figure.
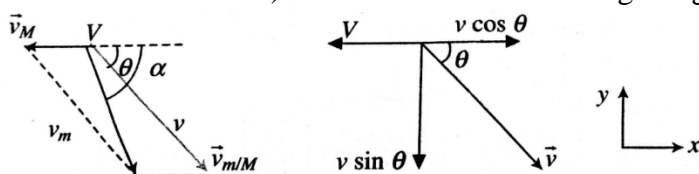


$\left|\vec{V}_m\right| = \sqrt{v^2 + V^2 + 2vV\cos\left(\pi - \theta\right)} = \sqrt{v^2 + V^2 - 2vV\cos\theta}$ we can derive this result by resolving v into

its components .Sum of x-components $V_x = v\cos\theta - V$

Sum of y-components $V_y = v\sin\theta$

Resultant velocity $\sqrt{V_x^2 + V_y^2} = \sqrt{\left(v\cos\theta - V\right)^2 + \left(v\sin\theta\right)^2} = \sqrt{v^2 + V^2 - 2vV\cos\theta}$

$$\tan\alpha = \frac{V_y}{V_x} = \frac{v\sin\theta}{v\cos\theta - V}$$

37.  2)When the procession is stationary, the flags flutter along the north-east direction. It means wind is flowing along the north-east direction. The flags will start fluttering along the direction of the relative velocity of wind w.r.t procession.
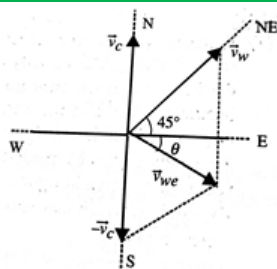
$$\vec{v}_{wc} = \vec{v}_w - \vec{v}_c = \left(30\sqrt{2}\cos 45^0\hat{i} + 30\sqrt{2}\sin 45^0\hat{j}\right) - 40\hat{j} = 30\hat{i} - 10\hat{j}\left(ms^{-1}\right)$$

$$\tan\theta = \frac{10}{30} = \frac{1}{3}$$

So the flag will flutter in a direction at $\theta = \tan^{-1}(1/3)$ S of E

38. 1)The velocity of bird with respect to wind can be given as
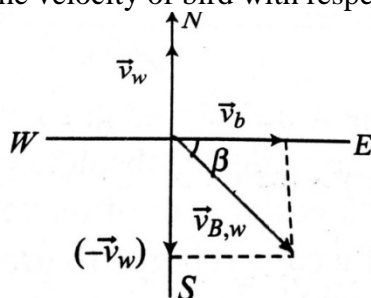


$$\vec{v}_{b,w} = \vec{v}_b - \vec{v}_w = \vec{v}_b + \left(-\vec{v}_w\right) = 4\hat{i} + \left(-3\hat{j}\right)\left(ms^{-1}\right) = 4\hat{i} - 3\hat{j}\left(ms^{-1}\right)$$

$$\left|\vec{v}_{b},w\right| = \sqrt{(4)^2 + (3)^2} = 5ms^{-1}$$

Here the direction of the relative velocity of the bird is

$$\left|\tan\beta\right| = \frac{3}{4} \Rightarrow \beta = \tan^{-1}\left(\frac{3}{4}\right)$$

Hence, the relative velocity of the bird with respect to wind is $5ms^{-1}$ and in the direction $\tan^{-1}\left(\frac{3}{4}\right)$ from

east toward south

39. 1)

40. 1)Given $\theta = 60^0$ and velocity of person $\vec{v}_P = \overrightarrow{OA} = 20ms^{-1}$

This velocity is same as the velocity of person w.r.t ground. First of all let us see how the diagram works out.

$\vec{v}_{rP} = \overrightarrow{OB} =$ Velocity of rain w.r.t person

$\vec{v}_r = \overrightarrow{OC} =$ velocity of rain w.r.t person

Values of $\vec{v}_r$ and $\vec{v}_{rP}$ can be obtained by using simple trigonometric relations

a) Speed of rain drops w.r.t Earth = $\vec{v}_r = \overrightarrow{OC}$

From $\Delta OAB, \frac{CB}{OC} = \sin 60^0 \Rightarrow OC = \frac{CB}{\sin 60^0} = \frac{20}{\sqrt{3}/2} = \frac{40}{\sqrt{3}} m/sec$

b) Speed of rain w.r.t the person, $\vec{v}_{rP} = \overrightarrow{OB}$

from $\dfrac{OB}{CB} = \cot 60^0 \Rightarrow OB = CB\cot 60^0 = \dfrac{20}{\sqrt{3}} m/\sec$

41. 3) Velocity of air (wind) $= \vec{v}_A = 100 kmh^{-1}$

Velocity of plane w.r.t air $= \vec{v}_{P/A} = 300 kmh^{-1}$

$\vec{v}_P = \vec{v}_{P/A} + \vec{v}_A$
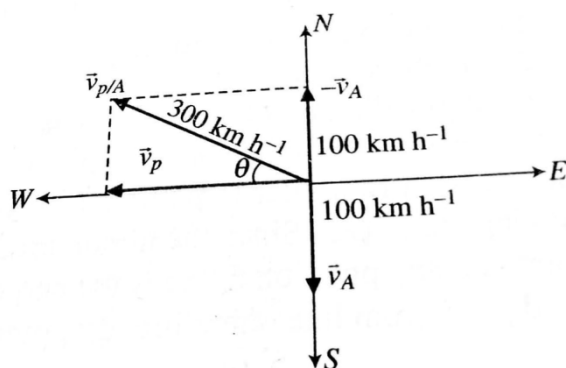


The velocity of the plane will be the vector sum of two velocities. Velocity of air and velocity of plane w.r.t air: if the plane is to move towards west finally, then the N-S component of velocity should be zero. For this

$\vec{v}_{P/A}\sin\theta = \vec{v}_A$

$\Rightarrow 300\sin\theta = 100 \Rightarrow \sin\theta = \dfrac{1}{3} \Rightarrow \theta = \sin^{-1}\left(\dfrac{1}{3}\right)$

So the pilot should head in direction $\theta = \sin^{-1}\left(\dfrac{1}{3}\right) N$ of $W$

Speed of plane w.r.t ground, $\vec{v}_P = \vec{v}_{P/A}\cos\theta = 300\sqrt{1-\sin^2\theta} = 300\sqrt{1-\left(\dfrac{1}{3}\right)^2} = 200\sqrt{2}kmh^{-1}$

42. 1) for B always to be north of A, the velocity components of both along east should be same

$v_2\cos 60^0 = v_1 \Rightarrow v_2 = 10 kmh^{-1}$

43. 2) Speed of train $= 108 \times \dfrac{5}{18} = 30 ms^{-1}$

Let $\vec{v}_R$ and $\vec{v}_T$ represent the respective velocities of rain and train. Now, the relative velocity of rain w.r.t person (train) is given by $v_{R.T} = \vec{v}_R - \vec{v}_T \Rightarrow \vec{v}_R + \left(-\vec{v}_T\right)$

Let $\overrightarrow{OR}$ and $\overrightarrow{RT}$ represent the vectors, respectively, in magnitude and direction
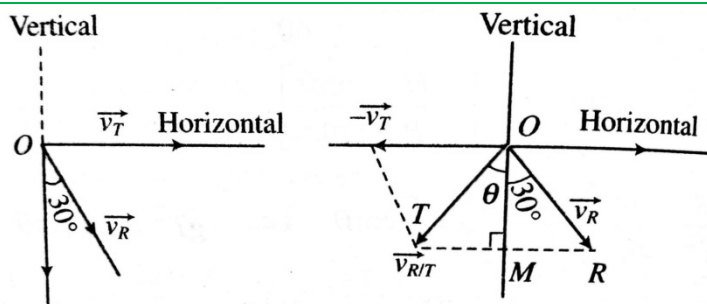
$$OT^2 = OR^2 + RT^2 + 2OR.RT\cos 120^0 = 20^2 + 30^2 - 2\times 20\times 30\times\frac{1}{2}$$

$$= 400 + 900 - 600 = 700 = \sqrt{700}\,\text{ms}^{-1} = 10\sqrt{7}\,\text{ms}^{-1}$$

44. 1) Motion of the person making an angel (say $\alpha$) with the downstream
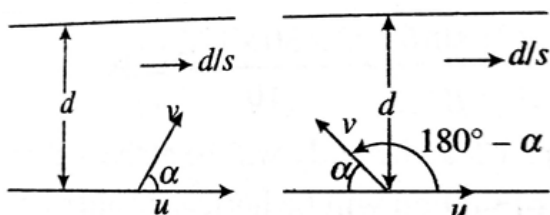


The time taken to cross the river $= \dfrac{d}{v\sin\alpha}$

The distance carried away downstream in the same time $=$ speed $\times$ time

$$x_1 = (u + v\cos\alpha)\frac{d}{v\sin\alpha}$$

Motion of the person making $\alpha$ angle with upstream

The time taken to cross the river is equal to $\dfrac{d}{v\sin\alpha}$

Distance carried away downstream in the same time

$$x_2 = \left[u + v\cos(180^0 - \alpha)\right]\frac{d}{v\sin\alpha}$$

$$\Rightarrow x_2 = (u - v\cos\alpha)\frac{d}{v\sin\alpha}\ \text{given}\ \frac{(u + v\cos\alpha)\dfrac{d}{v\sin\alpha}}{(u - v\cos\alpha)\dfrac{d}{v\sin\alpha}} = \frac{2}{1}$$

$$\frac{(u + v\cos\alpha)}{(u - v\cos\alpha)} = \frac{2}{1} \Rightarrow 3v\cos\alpha = u \Rightarrow \frac{v}{u} = \frac{\sec\alpha}{3}$$

$$\sec\alpha \geq 1 \Rightarrow \frac{\sec\alpha}{3} \geq \frac{1}{3}$$

From Eq. (iii), $\dfrac{v}{u} \geq \dfrac{1}{3}$ so v/u cannot be less than 1/3.

45. 3) case I : Let $\overrightarrow{OP} = 3\hat{i}$ be the velocity of man. $\overrightarrow{OQ}$ be the velocity of rain. PQ is the velocity of rain relative to man.

Case II: $\overrightarrow{OR} = 6\hat{i}$ is the new velocity of man

$\overrightarrow{RQ}$ = new velocity of rain relative to an

$OP = PR = PQ = 3$ Now $OQ^2 = OP^2 + PQ^2$, i.e., $OQ^2 = 3^2 + 3^2$ i.e., $OQ = 3\sqrt{2}\,\text{kmh}^{-1}$ and

$$\tan\theta = \frac{PQ}{OP} = \frac{3}{3} = 1, \text{ i.e., } \theta = 45^0$$
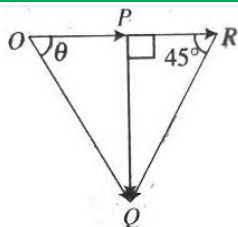
46.     3) The magnitude will decrease till the direction of the velocity with respect to man becomes vertical . It will increase thereafter.

47.     2) $y_m$ is largest when $\theta = 90^0$ from the horizontal. So, time of flight is largest.

48.     1) $T = \dfrac{2u\sin\theta}{g}$, lesser is the value of $\theta$, lesser is $\sin\theta$ and hence lesser will be the time taken. Hence A will fall earlier.

49.     (4) Here velocity is acting upwards when projectile is going upwards and acceleration is downwards. The angle $\theta$ between $\vec{v}$ and $\vec{a}$ is more than 0° and less than 180°.

50.     (c) Since range on horizontal plane is $R = \dfrac{u^2 \sin 2\theta}{g}$ so it is max. when $\sin 2\theta = 1 \Rightarrow \theta = \dfrac{\pi}{4}$

51.     4) $\dfrac{u^2 2\sin\theta\cos\theta}{g} = 2 \times \dfrac{u^2 \sin^2\theta}{2g}$ or $\tan\theta = 2$

52.     4) $\left(45^0 - \theta\right) \& \left(45^0 + \theta\right)$ are complementary angles as $45^0 - \theta + 45^0 + \theta = 90^0$ We know that if angle of projection of two projectiles make complementary angles, their ranges are equal. In this case also, the range will be same. So the ratio is 1 : 1.

53.     2) $R = h = \dfrac{u^2 \sin 2\theta}{g}$ when $2\theta = 90^0 \Rightarrow \dfrac{u^2}{g} = h$

        Height H is given by: $H = \dfrac{u^2 \sin^2\theta}{2g}$ when $\theta = 90^0, H = H_{max} = \dfrac{u^2}{2g} = \dfrac{h}{2}$

54.     4) $\dfrac{H_1}{H_2} = \dfrac{u^2 \sin^2\theta / 2g}{u^2 \sin^2\left(90^0 - \theta\right)} = \tan^2\theta$

55.     4) Time of flight $= \dfrac{2u\sin\theta}{g} = \dfrac{2 \times 9.8 \times \sin 30^0}{9.8} = 2 \times \dfrac{1}{2} = 1 \sec$

56.     3) We know that, $y_m = H = \dfrac{\left(u\sin\theta\right)^2}{2g} = \dfrac{u^2 \sin^2\theta}{2g}$

        $\therefore \dfrac{\Delta H}{H} = \dfrac{2\Delta u}{u}$ given $\dfrac{\Delta u}{u} = 2\%$

        $\therefore \dfrac{\Delta H}{H} = 2 \times 2 = 4\%$

57.     3) Only in case of parabolic motion, the direction and magnitude of the velocity changes, acceleration remains same. Morever, in case of uniform circular motion, the direction changes.

58.     3) At the highest point, the slope is zero and curvature is positive.

59.     2) $R_{15^0} = \dfrac{u^2 \sin\left(2 \times 15^0\right)}{g} = \dfrac{u^2}{2g} = 1.5 km$

        $R_{45^0} = \dfrac{u^2 \sin\left(2 \times 45^0\right)}{g} = \dfrac{u^2}{g} = 1.5 \times 2 = 3 km$

60.     3) $u_y = 0, s_y = -h, a_y = -g, t_y = ?$

$$s = ut + \frac{1}{2}at^2$$
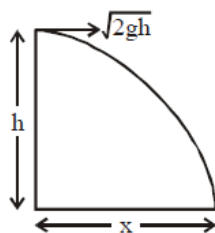


$$\therefore -h = -\frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2h}{g}}$$

Velocity = x/t

$$\therefore x = \sqrt{2gh} \times \sqrt{\frac{2h}{g}} = 2h$$

61.    1) R is same for both $\theta$ and $(90 - \theta)$. If angle w.r.t. vertical is 40º then w.r.t. horizontal direction it will be 90º – 40º = 50º.

62.    2) Comparing the given equation with $y = x\tan\theta - \dfrac{gx^2}{2u^2\cos^2\theta}$, we get $\tan\theta = \sqrt{3}$

63.    2) The bullets are fired at the same initial speed

$$\frac{H}{H^{'}} = \frac{u^2\sin^2 60^0}{2g} \times \frac{2g}{u^2\sin^2 30^0} = \frac{\sin^2 60^0}{\sin^2 30^0} = \frac{\left(\sqrt{3}/2\right)^2}{\left(1/2\right)^2} = 3/1$$

64.    3) On earth, $R = u^2\sin 2\theta / g$ on moon, $g^{'} = g/6$ $R^{'} = u^2\sin 20/g^{'} = 6u^2\sin 2\theta/g = 6R$

65.    4) Standard equation of projectile motion

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$$

Comparing with given equation

$$A = \tan\theta \ \text{ and } \ B = \frac{g}{2u^2\cos^2\theta}$$

So $\dfrac{A}{B} = \dfrac{\tan\theta \times 2u^2\cos^2\theta}{g} = 40$

66.    1) We know, $R = 4H\cot\theta \Rightarrow \cot\theta = \dfrac{1}{2}$ From triangle we can say that $\sin\theta = \dfrac{2}{\sqrt{5}}, \cos\theta = \dfrac{1}{\sqrt{5}}$
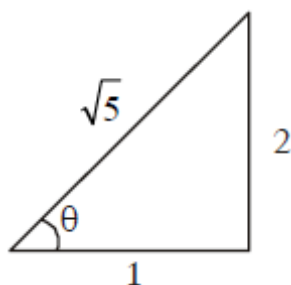


$$\therefore \text{Range of projectile } R = \frac{2v^2\sin\theta\cos\theta}{g} = \frac{2v^2}{g} \times \frac{2}{\sqrt{5}} \times \frac{1}{\sqrt{5}} = \frac{4v^2}{5g}$$

67.    3) As, $s = u\sin\theta t - \dfrac{1}{2}gt^2$ so $40 = 20\sqrt{3} \times \left(\sqrt{3}/2\right)t - \dfrac{1}{2} \times 10 \times t^2$ or $5t^2 - 30t + 40 = 0$ or $t^2 - 6t + 8 = 0$

Or t = 2 or 4.
The minimum time t = 2s.

68.    2) Time taken for vertical direction motion

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 490}{9.8}} = \sqrt{100} = 10s$$

The same time is for horizontal direction.

$$\therefore x = vt = \left(60 \times \frac{5}{18}\right) \times 10 = \frac{500}{3} m$$

69.  4) The horizontal velocity of the projectile remains constant throughout the journey. Since the body is projected horizontally, the initial velocity will be same as the horizontal velocity at any point. Since,

$$x = 2t, \frac{dx}{dt} = 2$$

∴  Horizontal velocity = 2 m/s
∴  Initial velocity = 2 m/s

70.  4) Max. Height = H = $\dfrac{v^2 \sin^2(90 - \theta)}{2g}$ .......(i)

Time of flight, T = $\dfrac{2v \sin(90 - \theta)}{g}$ .......(ii)

From (i), $\dfrac{v \cos \theta}{g} = \sqrt{\dfrac{2H}{g}}$, from (ii)
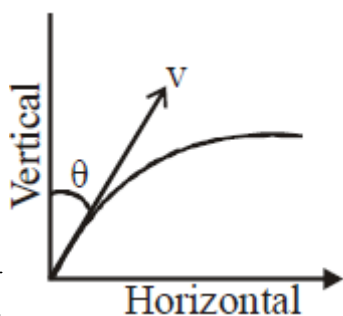


$$T = 2\sqrt{\frac{2H}{g}} = \sqrt{\frac{8H}{g}}$$

71.  2)
72.  3)
73.  2) Two bodies will collide at the highest point if both cover the same vertical height in the same time.

So $\dfrac{V_1^2 \sin^2 30^0}{2g} = \dfrac{V_2^2}{2g} \Rightarrow \dfrac{V_2}{V_1} = \sin 30^0 = \dfrac{1}{2} \therefore V_2 = \dfrac{1}{2}V_1$

74.  2) The horizontal range is the same for the angles of projection $\theta$ and $(90 - \theta)$

$$t_1 = \frac{2u \sin \theta}{g}, t_2 = \frac{2u \sin(90^0 - \theta)}{g} = \frac{2u \cos \theta}{g}$$

$$t_1 t_2 = \frac{2u \sin \theta}{g} \times \frac{2u \cos \theta}{g} = \frac{2}{g}\left[\frac{u^2 \sin 2\theta}{g}\right] = \frac{2}{g}R$$

where R = $\dfrac{u^2 \sin 2\theta}{g}$ Hence $t_1 t_2 \propto R$ (as R is constant)

75.  3)
76.  1)
77.  2) As ball is projected at an angle 45° to the horizontal therefore Range = 4H or

$$10 = 4H \Rightarrow H = \frac{10}{4} = 2.5m$$

$$\left( \because \text{Range} = 4m + 6m = 10m \right)$$
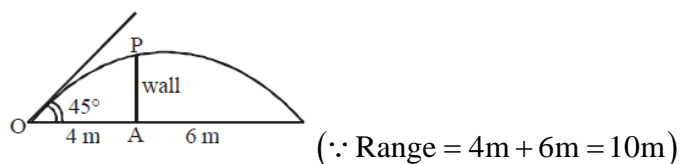
Maximum height, $H = \dfrac{u^2 \sin^2 \theta}{2g}$

$$\therefore u^2 = \dfrac{H \times 2g}{\sin^2 \theta} = \dfrac{2.5 \times 2 \times 10}{\left(\dfrac{1}{\sqrt{2}}\right)^2} = 100 \text{ or, } u = \sqrt{100} = 10 \text{ ms}^{-1}$$

Height of wall $PA = OA \tan \theta - \dfrac{1}{2} \dfrac{g(OA)^2}{u^2 \cos^2 \theta}$

$$= 4 - \dfrac{1}{2} \times \dfrac{10 \times 16}{10 \times 10 \times \dfrac{1}{\sqrt{2}} \times \dfrac{1}{\sqrt{2}}} = 2.4 \text{ m}$$

78.      4) $R = \dfrac{u^2 \sin^2 \theta}{g}, H = \dfrac{u^2 \sin^2 \theta}{2g}$

$H_{max}$ at $2\theta = 90^0$

$H_{max} = \dfrac{u^2}{2g}$

$\dfrac{u^2}{2g} = 10 \Rightarrow u^2 = 10g \times 2$

$R = \dfrac{u^2 \sin 2\theta}{g} \Rightarrow R_{max} = \dfrac{u^2}{g}$

$R_{max} = \dfrac{10 \times g \times 2}{g} = 20 \text{ metre}$

79.      2) At point B the direction of velocity component of the projectile along Y - axis reverses.
Hence, $\vec{V}_B = 2\hat{i} - 3\hat{j}$

80.      3) $V_y = u \sin \theta = gt_m = 0$

$\therefore t_m = \dfrac{u_y \sin \theta}{g}$ (time to reach the maximum height)

Total time of flight $T_f = \dfrac{2(u \sin \theta)}{g}$

$\therefore T_f = 2t_m$

81.      3) In circular motion with constant speed, acceleration is always inward, its magnitude is constant but direction changes, hence acceleration changes, so does velocity

82.      4) $\Delta v = \sqrt{2}v = \sqrt{2}\omega r = \sqrt{2}\left(\dfrac{2\pi}{60}\right) \times 1 = \dfrac{\pi\sqrt{2}}{30} \text{ cm/s}$

83. 1) $a_c = \dfrac{v^2}{r} = \dfrac{(250)^2}{10^3} = 62.5 \, m/s^2 \Rightarrow a_c/g = \dfrac{62.5}{9.8} = 6.38$

84. 3) Given : r = 30 cm = 0.3 cm = 0.3 m and V = 2t Radial acceleration at t = 3 sec

$a_r = \dfrac{v^2}{r} = \dfrac{4t^2}{0.3} = \dfrac{4 \times (3)^2}{0.3} = 120 \, m/s^2$ and tangential acceleration $a_t = \dfrac{dv}{dt} = 2 \, m/s^2$

85. 2) From the geometry of the figure, the angle traverses about A and C are $\theta$ and $2\theta$ respectively. So
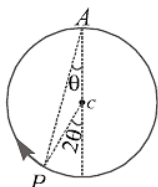


$\omega_A = \dfrac{\theta}{t}$ and $\omega_C = \dfrac{2\theta}{t} = 2\omega_A$

86. 3) Here $T = \dfrac{1}{2}$ sec the required centripetal acceleration for moving in a circle is

$a_C = \dfrac{v^2}{r} = \dfrac{(r\omega)^2}{r} = r\omega^2 = r \times (2\pi/T)^2$ so $a_c = 0.25 \times (2\pi/0.5)^2 = 16\pi^2 \times .25 = 4.0\pi^2$

87. 3)
88. 4)
89. 1) Distance covered in one circular loop $= 2\pi r = 2 \times 3.14 \times 100 = 628 m$

Speed $= \dfrac{628}{62.8} = 10 \, m/sec$

Displacement in one circular loop = 0

Velocity $= \dfrac{0}{time} = 0$

90. 3) Given $\omega = 2 \, rad \, s^{-1}, r = 2m, t = \dfrac{\pi}{2} s$

Angular displacement, $\theta = \omega t = 2 \times \dfrac{\pi}{2} = \pi \, rad$

Linear velocity, $v = r \times \omega = 2 \times 2 = 4 ms^{-1}$

$\therefore$ change in velocity, $\Delta v = 2v \sin \dfrac{\theta}{2} = 2 \times 4 \times \sin\left(\dfrac{\pi}{2}\right) = 8 m/s$

## NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. 2) Here, $x = 4\sin(2\pi t) ......(i)$

$y = 4\cos(2\pi t) ....(ii)$

Squaring and adding equation (*i*) and (*ii*)

x2 + y2 = 42 □□R = 4 Motion of the particle is circular motion, acceleration vector is along $-\vec{R}$ and its

magnitude= $\dfrac{V^2}{R}$

Velocity of particle, $V = \omega R = (2\pi)(4) = 8\pi$

$\vec{v}_{av} = \dfrac{\Delta \vec{r}(displacement)}{\Delta t(time \ taken)} = \dfrac{(13-2)\hat{i} + (14-3)j}{5-0} = \dfrac{11}{5}(\hat{i} + \hat{j})$

2. 4)

3. 1)

v = 20 m/s ; u = 10 m/s
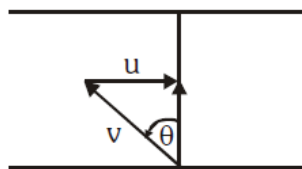
$$\sin\theta = \frac{u}{v} = \frac{10}{20} = \frac{1}{2}$$

$$\Rightarrow \quad \theta = 30° \text{ west}$$

4.  3)
5.  1)
6.  **3).**

$$4R = \frac{u^2 \sin^2\theta}{2g}, T = \frac{2\pi R}{u}$$

$$u = \frac{2\pi R}{T}$$

$$4R = \frac{4\pi^2 R^2}{T^2} \times \frac{\sin^2\theta}{2g}$$

$$\sin^2\theta = \frac{2gT^2}{\pi^2 R}; \sin\theta = \sqrt{\frac{2gT^2}{\pi^2 R}}; \theta = \sin^{-1}\left(\frac{2gT^2}{\pi^2 R}\right)^{1/2}$$

7.  3)

Initial velocity of car = 0

Acceleration of car = 5 m/s²

Velocity of car at $t$ = 4 s; $v = u + at$

$\Rightarrow v = 0 + 5 \times 4 = 20$ ms⁻¹

At $t$ = 4 s, A ball is dropped out of a window so velocity of ball at this instant is 20 ms⁻¹ along horizontal.

After 2 seconds of motion :

Horizontal velocity of ball = 20 ms⁻¹ ($\because a_x = 0$)

Vertical velocity of ball ($v_y$) = $u_y + a_y t$

$v_y = 0 + 10 \times 2 = 20$ ms⁻¹ ($\because a_y = g = 10$ m/s²)

So magnitude of velocity of ball

$(v) = \sqrt{v_x^2 + v_y^2} = 20\sqrt{2}$ m/s

Acceleration of ball at $t$ = 6 s is $g$ = 10 m/s²

As ball is under free fall.

8.  $a = \dfrac{\omega_2 - \omega_1}{t} = \dfrac{2\pi(52-20)}{16} = 4\pi$

9.  $\tan\theta = V$

$\dfrac{V_1}{V_2} = \dfrac{\tan\theta_1}{\tan\theta_2} = \dfrac{\tan 30^0}{\tan 45^0} = \dfrac{1/\sqrt{3}}{1} = 1 : \sqrt{3}$

10. Velocity at highest point $= u\sin\theta$

$= 10\sin 60^0 = 5\sqrt{3} \, ms^{-1}$

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## Kindergarten to Class XII (For Teachers Only)

**Click Here to Join**  
**Class 1**

**Click Here to Join**  
**Class 2**

**Click Here to Join**  
**Class 3**

**Click Here to Join**  
**Class 4**

**Click Here to Join**  
**Class 5**

**Click Here to Join**  
**Class 6**

**Click Here to Join**  
**Class 7**

**Click Here to Join**  
**Class 8**

**Click Here to Join**  
**Class 9**

**Click Here to Join**  
**Class 10**

**Click Here to Join**  
**Class 11 (Science)**

**Click Here to Join**  
**Class 11 (Humanities)**

**Click Here to Join**  
**Class 11 (Commerce)**

**Click Here to Join**  
**Class 12 (Science)**

**Click Here to Join**  
**Class 12 (Humanities)**

**Click Here to Join**  
**Class 12 (Commerce)**

**Click Here to Join**  
**Kindergarten**

# Subject Wise Secondary and Senior Secondary Groups (IX & X For Teachers Only)

## Secondary Groups (IX & X)

Click Here to Join
**SST**

Click Here to Join
**Mathematics**

Click Here to Join
**Science**

Click Here to Join
**English**

Click Here to Join
**Hindi-A**

Click Here to Join
**IT Code-402**

Click Here to Join
**Hindi-B**

Click Here to Join
**Artificial Intelligence**

## Senior Secondary Groups (XI & XII For Teachers Only)

Click Here to Join
**Physics**

Click Here to Join
**Chemistry**

Click Here to Join
**English**

Click Here to Join
**Mathematics**

Click Here to Join
**Biology**

Click Here to Join
**Accountancy**

Click Here to Join
**Economics**

Click Here to Join
**BST**

Click Here to Join
**History**

**Click Here to Join** Geography

**Click Here to Join** Sociology

**Click Here to Join** Hindi Elective

**Click Here to Join** Hindi Core

**Click Here to Join** Home Science

**Click Here to Join** Sanskrit

**Click Here to Join** Psychology

**Click Here to Join** Political Science

**Click Here to Join** Painting

**Click Here to Join** Vocal Music

**Click Here to Join** Comp. Science

**Click Here to Join** IP

**Click Here to Join** Physical Education

**Click Here to Join** APP. Mathematics

**Click Here to Join** Legal Studies

**Click Here to Join** Entrepreneurship

**Click Here to Join** French

**Click Here to Join** IT

**Click Here to Join** Artificial Intelligence

# Other Important Groups (For Teachers & Principal's)

**Click Here to Join** Principal's Group

**Click Here to Join** Teachers Jobs

**Click Here to Join** IIT/NEET

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## Kindergarten to Class XII (For Students Only)

**Click Here to Join**   **Class 1**

**Click Here to Join**   **Class 2**

**Click Here to Join**   **Class 3**

**Click Here to Join**   **Class 4**

**Click Here to Join**   **Class 5**

**Click Here to Join**   **Class 6**

**Click Here to Join**   **Class 7**

**Click Here to Join**   **Class 8**

**Click Here to Join**   **Class 9**

**Click Here to Join**   **Class 10**

**Click Here to Join**   **Class 11 (Science)**

**Click Here to Join**   **Class 11 (Humanities)**

**Click Here to Join**   **Class 11 (Commerce)**

**Click Here to Join**   **Class 12 (Science)**

**Click Here to Join**   **Class 12 (Humanities)**

**Click Here to Join**   **Class 12 (Commerce)**

**Click Here to Join**   **Artificial Intelligence (VI TO VIII)**

# Subject Wise Secondary and Senior Secondary Groups (IX & X For Students Only)

## Secondary Groups (IX & X)

| | | |
|---|---|---|
| **SOE** Click Here to Join | **SOE** Click Here to Join | **SOE** Click Here to Join |
| **SST** | **Mathematics** | **Science** |
| **SOE** Click Here to Join | **SOE** Click Here to Join | **SOE** Click Here to Join |
| **English** | **Hindi** | **IT Code** |
| | **SOE** Click Here to Join | |
| | **Artificial Intelligence** | |

## Senior Secondary Groups (XI & XII For Students Only)

| | | |
|---|---|---|
| **SOE** Click Here to Join **Physics** | **SOE** Click Here to Join **Chemistry** | **SOE** Click Here to Join **English** |
| **SOE** Click Here to Join **Mathematics** | **SOE** Click Here to Join **Biology** | **SOE** Click Here to Join **Accountancy** |
| **SOE** Click Here to Join **Economics** | **SOE** Click Here to Join **BST** | **SOE** Click Here to Join **History** |

| | | |
|---|---|---|
| **Click Here to Join**<br>**Geography** | **Click Here to Join**<br>**Sociology** | **Click Here to Join**<br>**Hindi Elective** |
| **Click Here to Join**<br>**Hindi Core** | **Click Here to Join**<br>**Home Science** | **Click Here to Join**<br>**Sanskrit** |
| **Click Here to Join**<br>**Psychology** | **Click Here to Join**<br>**Political Science** | **Click Here to Join**<br>**Painting** |
| **Click Here to Join**<br>**Music** | **Click Here to Join**<br>**Comp. Science** | **Click Here to Join**<br>**IP** |
| **Click Here to Join**<br>**Physical Education** | **Click Here to Join**<br>**APP. Mathematics** | **Click Here to Join**<br>**Legal Studies** |
| **Click Here to Join**<br>**Entrepreneurship** | **Click Here to Join**<br>**French** | **Click Here to Join**<br>**IT** |
| **Click Here to Join**<br>**AI** | **Click Here to Join**<br>**IIT/NEET** | **Click Here to Join**<br>**CUET** |

# Groups Rules & Regulations:

**To maximize the benefits of these WhatsApp groups, follow these guidelines:**

1. Share your valuable resources with the group.
2. Help your fellow educators by answering their queries.
3. Watch and engage with shared videos in the group.
4. Distribute WhatsApp group resources among your students.
5. Encourage your colleagues to join these groups.

**Additional notes:**
1. Avoid posting messages between 9 PM and 7 AM.
2. After sharing resources with students, consider deleting outdated data if necessary.
3. It's a NO Nuisance groups, single nuisance and you will be removed.
   - No introductions.
   - No greetings or wish messages.
   - No personal chats or messages.
   - No spam. Or voice calls
   - Share and seek learning resources only.

**Please only share and request learning resources. For assistance, contact the helpline via WhatsApp: +91-95208-77777.**

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**Class 9**



**Class 10**



**Class 11**



**Class 12**

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**Best Wishes,**

**Team**
**School of Educators & Artham Resources**

# SKILL MODULES BEING OFFERED IN MIDDLE SCHOOL

Artificial Intelligence

Beauty & Wellness

Design Thinking & Innovation

Financial Literacy

Handicrafts

Information Technology

Marketing/Commercial Application
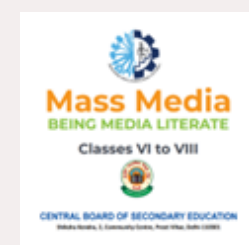
Mass Media - Being Media Literate

Travel & Tourism

Coding
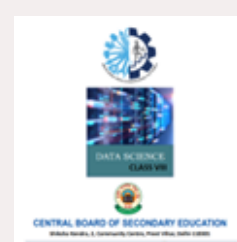
Data Science (Class VIII only)
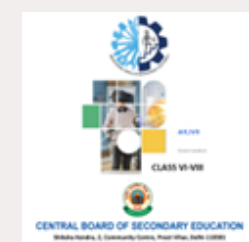
Augmented Reality / Virtual Reality
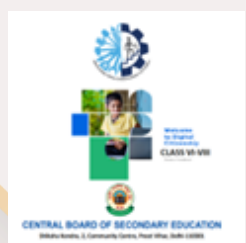
Digital Citizenship
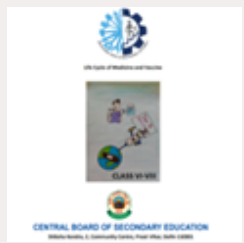
Life Cycle of Medicine & Vaccine
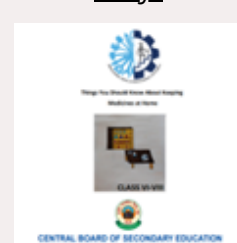
Things you should know about keeping Medicines at home

What to do when Doctor is not around
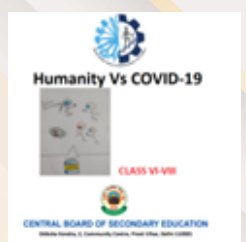
Humanity & Covid-19

Blue Pottery
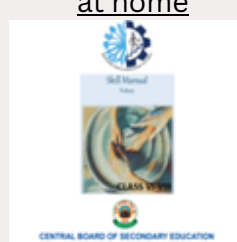
Pottery

Block Printing
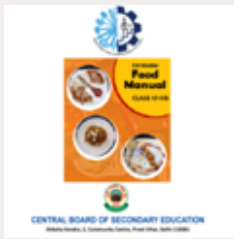
Food
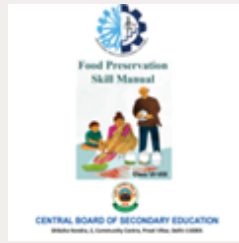

Food Preservation


Baking
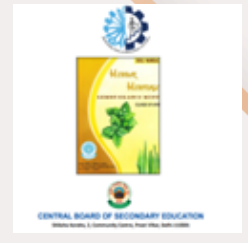

Herbal Heritage


Khadi
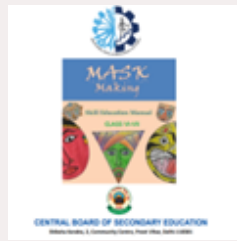

Mask Making


Mass Media
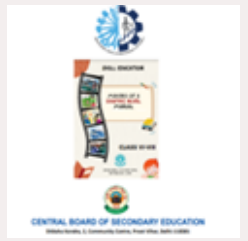

Making of a Graphic Novel
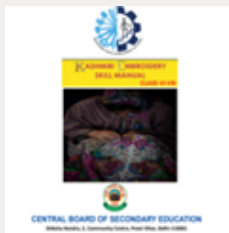

Kashmiri Embroidery


Embroidery


Rockets
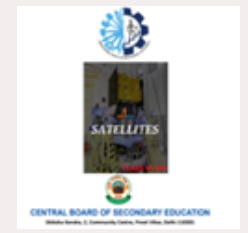

Satellites
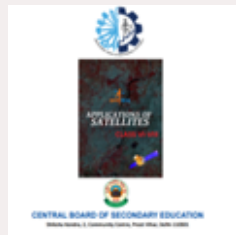

Application of Satellites
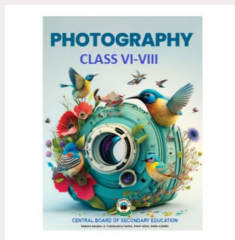

Photography

# SKILL SUBJECTS AT SECONDARY LEVEL (CLASSES IX – X)
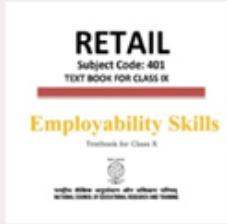
Retail
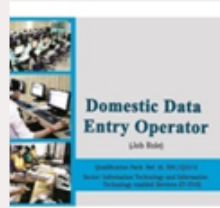
Information Technology

Security

Automotive

Introduction To Financial Markets
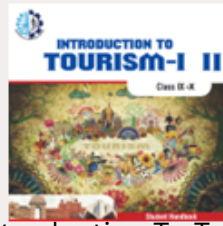
Introduction To Tourism
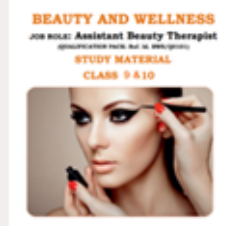
Beauty & Wellness
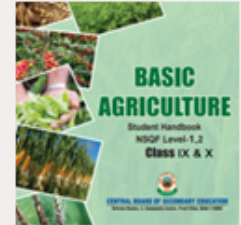
Agriculture

Food Production

Front Office Operations

Banking & Insurance

Marketing & Sales

Health Care

Apparel

Multi Media

Multi Skill Foundation Course

Artificial Intelligence

Physical Activity Trainer

Data Science

Electronics & Hardware (NEW)

Foundation Skills For Sciences (Pharmaceutical & Biotechnology)(NEW)

Design Thinking & Innovation (NEW)

# SKILL SUBJECTS AT SR. SEC. LEVEL
# (CLASSES XI – XII)
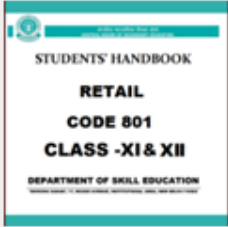
Retail

InformationTechnology

Web Application

Automotive

Financial Markets Management

Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

Banking

Marketing

Health Care

Insurance

Horticulture
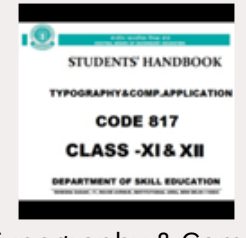
Typography & Comp. Application
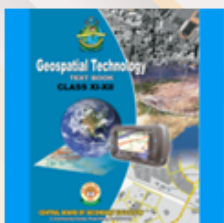
Geospatial Technology
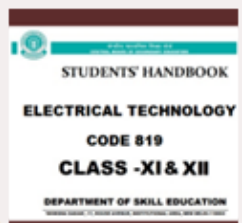
Electrical Technology

Electronic Technology
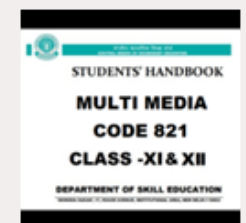
Multi-Media

Taxation


Cost Accounting
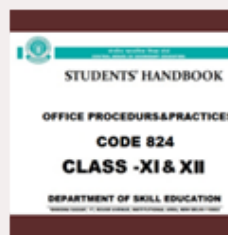

Office Procedures & Practices
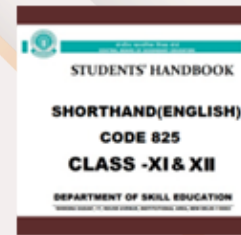

Shorthand (English)
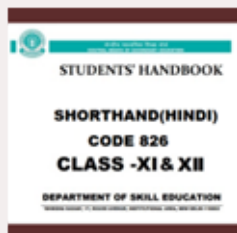

Shorthand (Hindi)
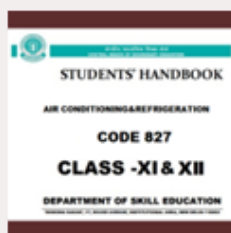

Air-Conditioning & Refrigeration
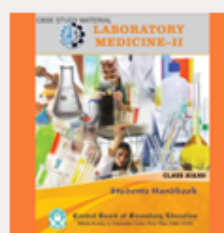

Medical Diagnostics
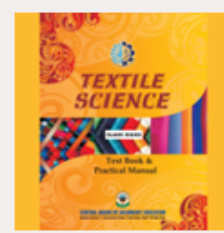
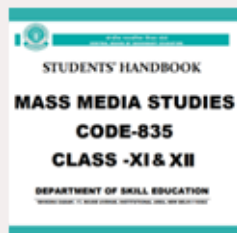
Textile Design
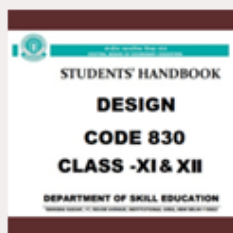

Design
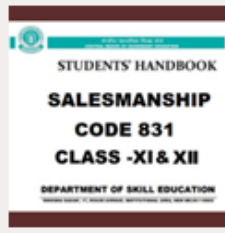

Salesmanship
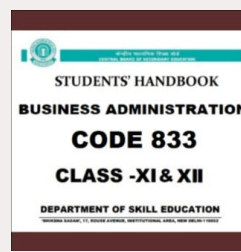

Business Administration
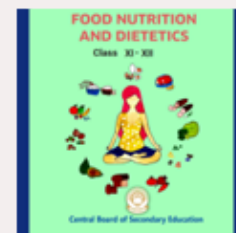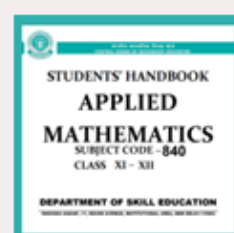

Food Nutrition & Dietetics


Mass Media Studies


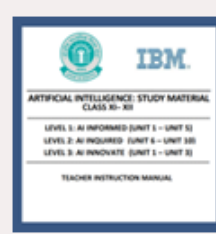Library & Information Science


Fashion Studies


Applied Mathematics


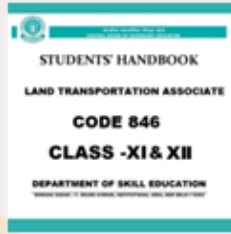Yoga


Early Childhood Care & Education


Artificial Intelligence


Data Science


Physical Activity Trainer(new)


Land Transportation Associate (NEW)


Electronics & Hardware (NEW)


Design Thinking & Innovation (NEW)